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ABSTRACT

A usage study of monograph and serial library holdings at the University of Cincinnati was conducted in 1982 to select candidates for retrospective conversion of catalog records and to determine what materials would be housed in a remote storage facility. The study measured both inhouse and circulation use for each Library of Congress (LC) subclassification. Methodologies from other use studies by L. E. Middleswort, Herman Fussler and J. L. Simon, Richard Trueswell, Allan Kent, and Mary Jane Pobst Reed were adapted for use in the Cincinnati study. It was found that material showing charges back to 1977 (six years) and 1975 would have to be kept in the main collection to satisfy circulation and inhouse demand respectively; materials with recent imprints received far more use than older materials although it was not possible to determine a cutoff date which would enable the library to meet 90% of user needs; the overall ratio of monographs to serials used was 1.3 to 1 but this ratio changed rapidly over time; disciplines in the sciences and social sciences showed the greatest use of serials and materials with recent imprints; and the humanities demonstrated less use of serials and a far more pronounced use of older materials. This report describes the study methodology and its results, uses in decision making, costs, and benefits. Extensive appendices provide information on the distribution of usage by LC subclassification. (Author/ESR)

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A STUDY OF COLLECTION USE AT THE UNIVERSITY OF CINCINNATI CENTRAL LIBRARY

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ABSTRACT

The development, implementation and application of a usage study conducted at the University of Cincinnati Central Library is traced. The study was undertaken in order to select candidates for retrospective conversion of catalog records and to determine what materials would be housed in a remote storage facility.

A review of the library literature on use studies focused on the methodology, findings, and criticism of studies by Middleswort, Fussler, Trueswell, Kent, and Reed. Methodologies from these studies were adapted to the institution's particular need for information and its capacity to gather that information. The study measured both in-house and out-of-library use for each Library of Congress subclassification.

The study discovered relationships between use and the variables of last date of charge, date of imprint, and type of material. The study confirmed the findings of many usage studies that material which has seen recent use accounts for a large percentage of total collection use. The percentage was not as pronounced, however, as that found by Trueswell. The study also confirmed earlier findings concerning the relationship between date of imprint and use, that is materials with recent imprints receive far more use than older materials. Some of the most interesting data concerned the relative usage of monographs and serials. The relationship between the two types of materials was found to change rapidly over time.

Subject disciplines were grouped into the broad categories of humanities, social sciences, and sciences. Disciplines in the sciences and social sciences showed the greatest use of serials and materials with recent imprints. The humanities demonstrated less use of serials and a far more pronounced use of older materials.

Finally, the study's value for collection development is assessed and it is evaluated in terms of success in meeting its objectives and in terms of cost.

TABLE OF CONTENTS

Purpose..... 1

Background..... 1

Review of Literature..... 5

Methodology..... 13

Validity of Study..... 16

Results and Conclusions..... 20

Using the Study for Decision Making..... 25

Recommendations for Further Research..... 28

Evaluation of Study..... 30

References..... 32

Appendixes

A. Breakdown of LC Subclasses by Discipline

B. Figures 1 through 9: Distribution of Use

C. Comparison of Usage Among Three Studies

D. Comparison of Usage Between Two Studies for Subclasses Formerly in Storage

A STUDY OF COLLECTION USE AT THE UNIVERSITY OF CINCINNATI CENTRAL LIBRARY

Purpose

The purpose of this research study was to determine the usage characteristics of a medium-size academic library collection and to demonstrate the potential usefulness of such information to decision making. Usage data was gathered by Library of Congress subclassifications at the Central Library of the University of Cincinnati. Further breakdowns within each subclass were made by type of material (monograph or serial), decade of imprint, and date of previous charge. The results were then applied to two library decisions: the selection of materials for retrospective conversion and the identification of materials for housing in storage.

Background

The University of Cincinnati is an urban university which offers over 40 doctoral programs and has professional schools in Law and Medicine. It is attended by over 35,000 students, about 38% of whom are part time. The university has a medium-to-large academic library system which is a member of the Association of Research Libraries. The law and medical libraries are administratively independent although they are considered with the University Libraries System (ULS) for purposes of ARL membership. The ULS is composed of the Central Library, ten college and departmental libraries (C&D's), and two branch campus libraries.

It holds more than one million bound monographs and serials. The Central Library is primarily a humanities and social sciences library but has supplemental materials in the sciences. It contains approximately 700,000 volumes.

The University of Cincinnati libraries are in the process of systems development. Plans call for the implementation of an online public access catalog and circulation system in June of 1984. As a charter member of OCLC, UC has been involved in shared cataloging through the utility since 1973. It has approximately 300,000 records now converted to machine readable form. The larger the data base of converted material, the more representative the online catalog will be of UC's holdings and the more efficient the operation will be of the circulation system. Because nearly a third of the holdings are already converted, only a small amount of money was diverted from other system's efforts and made available for retrospective conversion. The question was how to spend this money well.

The literature on retrospective conversion deals mainly with the various options for conversion, using a vendor or doing it in-house, and quality control issues. Little consideration is given to selecting items and no mention is made of employing use study as a decision tool. Nevertheless, a use study seemed to offer real advantages to decision making. Since the library was allocating only a small amount of money to retrospective conversion, it needed a tool which could assist librarians in determining items which were likely to be sought in the catalog and/or circulated.

The important factors for discriminating among candidates for

conversion were built into the study: type of material (monograph or serial), date of imprint, and date of previous circulation.

The ULS was also dealing with the problem of selecting material for storage. The storage collection had been merged temporarily with the Central Library collection in 1981 when Blegen Library was closed for renovation. With the renovation due to be completed in June 1983, the library needed to decide what would be retired to storage to relieve crowding. Since use studies find their most frequent application to making decisions related to storage, it was decided to use the study to assist in this effort as well.

While selecting candidates for storage on a title-by-title basis is more likely to produce a storage collection for which there is low demand than a method in which subject disciplines are selected for storage, selection by title is ungainly and expensive for totally manual systems. To list "storage" as a location in the card catalog would mean changing a vast number of records. It would be both expensive in terms of man-hours and contribute to the growing cataloging backlog of new acquisitions by diverting staff away from that task. Alternatives to changing catalog cards are to inform patrons of location of materials in storage either through a collections directory handout or by relying on circulation records to convey this information. A collections directory can be used for a limited number of individual serial titles but is a wholly unfeasible approach for use with monographs. Circulation records can be used for monographs and serials on a title basis, but such an approach presupposes that most patrons seeking an item not on the shelf will go to Circulation to inquire about it. For these reasons, it was decided to

continue to select items for storage on the basis of subject disciplines. As a result, the use study reflects this by gathering information on use by LC subclassifications.

The same factors used to discriminate among candidates for conversion were thought to be of value for arriving at candidates for storage.

Review of the Literature

The underlying assumption of all use studies is that past use is a good predictor of future use. If this assumption is valid, use studies can be a tool that library collection managers use to make decisions which will maximize user satisfaction. If use can be predicted, management is in a position to know the probable impact of selection decisions concerning storage, acquisitions, and weeding at the time these decisions are made. Although this assumption has not gone unchallenged, F. W. Lancaster asserts, "...there exists considerable evidence to support it."[1]

The first important use studies were conducted at the University of Chicago for the purpose of selecting items for remote storage. In 1951, L. E. Middleswort discovered a high positive correlation between rate of circulation during the first five years after acquisition and rate of use later.[2]

The major pioneering work in use studies was conducted over a four-year period between 1954 and 1958 by Herman Fussler and J. L. Simon. They also found that records of past circulation were excellent predictors of future use. Further, their research established that records of past circulation were a better predictor than either language or publication date. Using only records of past circulation in studying two subject areas, economics and German, they found that 25% of the books could be retired while reducing use by only 3% and 12% respectively. Where records of past circulation were available for a twenty-year period, they found that it was possible to retire 25% of the books in these disciplines and only affect 1% of future use.[3]

Fussler and Simon were among the first to recognize the importance of in-house use. They provided free pens to patrons as an incentive to return survey forms indicating in-house use. They also placed the survey forms within the books in such a way that it was possible to tell if the books had been handled even if the forms were not returned. The study found a high positive correlation between in-house use and circulation. For example, if American history books are used in-house twice as often as European history books, their use, as measured by out-of-library circulation, will also be twice as great.

A number of others have studied in-house usage: William McGrath in 1971,[4] Anthony Hindle and Michael Buckland in 1978,[5] and C. Harris in 1977.[6] They verified the findings of Fussler and Simon that in-house use parallels circulation.

According to Robert Broadus, there is disagreement among the various studies as to the exact nature of the ratio between in-house use to out-of-library circulation. Those who measured material used at the shelf found that in-house use was higher. Fussler and Simon found it to be 3 to 9 times greater than circulation. Harris found it to be 20 times greater. McGrath, who counted only books left on tables, found in-building use lower than circulation. Interestingly, McGrath found that the ratio varied from collection to collection and within subject disciplines in the same collection.[7]

Perhaps the most influential research on the use of library collections after Fussler and Simon is the work of Richard Trueswell. Trueswell significantly improved the methodology of use studies by using the last date of circulation instead of recording the circulation history of each

item. This simplified data collection since the entire history of an item's circulation did not need to be recorded. The method also improved accuracy. Heavily used books go through book cards or date due slips quickly and may show few or no entries at the time of the study. This can greatly skew results if the entire circulation record is used. Trueswell's method minimized this problem.

The findings of Trueswell's research are also of major significance. His studies have repeatedly found that a small percentage of a library's collection accounted for a large percentage of the collection's circulation. He called this phenomenon the "80/20 Rule" after a similarly named rule in business which states that 80% of sales are generated by 20% of a company's inventory. Trueswell's study of the Air Force Cambridge Research Laboratory Library revealed exactly an 80/20 relationship.[8] A later study of three academic libraries, Mt. Holyoke College's Williston Memorial Library, the Deering Library at Northwestern University, and the Goodell Library at the University of Massachusetts revealed a 40/85, 50/90 and 60/90 relationship, respectively.[9] It is significant that these libraries vary considerably in size and scope of collection. Other studies by Trueswell, including at least one follow-up study, show similar results.[10]

Since last date of circulation can readily identify a core collection in a library, the method represents a valuable tool for stacks thinning, selecting candidates for storage, and making decisions concerning the acquisitions of multiple copies. For purposes of storage or weeding selection, a cutoff in terms of last date of circulation is determined based on space availability in a library's main collection and the known

relationship between last date of circulation and use.

Allan Kent's study of use at the University of Pittsburgh's Hillman Library is one of the most ambitious use studies ever undertaken. Its aim was to develop a cost-benefit model to:

1. improve acquisition decisions;
2. determine the point at which material could be placed in low-cost storage;
3. determine the critical point at which alternatives to local ownership are economically feasible.[11]

It traced the use of 1969 acquisitions for a seven-year peiod, and once again verified the value of past circulation data for predicting future use. It also supported the thrust of Trueswell's research. It found that only 51.63% of the monographs circulated during the period of the study. Further, 42.41% of items which circulated accounted for 80% of all circulation transactions.[12]

The most recently published collection use study was conducted by Mary Jane Pobst Reed at the Washington State Library in Olympia. The purpose of the study was to select monographs for remote storage. The last date of circulation was determined on a random sample of books. A cutoff date was established on the basis of the sample. Books with no record of circulation prior to the cutoff date were placed in storage. The study is of interest for three reasons. First, it collected circulation data for a sample period of only five days. Second, its findings support Trueswell's findings: 50% of the collection furnished 90% of all collection use. Third, and most important, Reed subsequently studied requests for the material which had been relegated to storage. She found that prediction of low future use

had been quite accurate. By modifying the cutoff period for last circulation by only two months, she was able to reduce storage requests by an additional two-thirds.[13]

As was pointed out earlier, use studies have always had their critics. The subject recently has taken on the proportions of a controversy with the publication of the Pittsburgh study. A number of factors probably account for this. First, the subject of the study, the Hillman Library and its branches at the University of Pittsburgh, is a large research collection. Second, the study's scope and comprehension was greater than anything which preceded it. Third, the study showed that a small percentage of the collection accounted for a large percentage of use. Fourth, cost-benefit analysis played a prominent role in the study. Some of these factors were present in earlier studies but not in combination nor to the degree of Kent's study. As much as anything else, the study's publication during a period of economic retrenchment probably accounted for the severity of the reaction. There was and still is a great fear that Kent's study will be used by university administrators to reduce library budgets.

Charges immediately surfaced that the study suffered problems in methodology and execution which invalidated its findings. Faculty and librarians at the University of Pittsburgh pointed out inconsistencies in data collection. They suggested that the study was a highly subjective and political document that merely had the "sheen of objectivity" due to its numerous tables and graphs.[14]

Jasper Schad questioned Kent's findings of low use. He pointed out that the number of 1969 acquisitions upon which the study was based was

inaccurate. Books missing or stolen at the time of the study were not tracked, although their missing status probably indicated use. Some of the circulation data also was missing or questionable. On the whole, Schad asserts, there was so much missing data that no accurate conclusions can be drawn from the study.[15] Another point raised by Schad is whether circulation accurately represents total collection use. Kent based his assumption about the relationship between in-house use and circulation on a 30-day study of in-building use. Schad claims the sample was too small and questions the logic of the assumptions Kent made in extrapolating the findings to the use of the whole collection.[16] Schad further criticizes the essential question being asked by the study. He suggests that, "...the Study does not demonstrate comprehension of the purpose of an academic research...library."[17] He argues that two very different uses are made of a university library: instructional support and research. He argues that one-based measure cannot appropriately be used to measure both.

On the other side, Trueswell supports both the findings and methods of the Pittsburgh Study. He suggests that librarians should not get so bogged down in numbers that they miss the central conclusions of the study. Trueswell points out that even if Schad is correct about the data collection, appropriate adjustments of the outcomes would still demonstrate that a large number of books were never used and that most circulation comes from a small portion of the collection.[18] He agrees with Schad that there are differences between research and undergraduate libraries. In the library solely committed to research, the kind of use measured by Kent probably is an insignificant measure of effectiveness. The problem, as Trueswell sees it, is that most libraries lie somewhere in between the pure research library and the

undergraduate library devoted to instructional support. Consequently, the results of use studies have importance to most libraries. He suggests that a library must look closely at its prime objectives before trying to assess the appropriateness of the results of use studies in their institutions.

While the argument over the Pittsburgh Study persists and promises no quick resolution, there is general agreement in the literature about the shortcomings and pitfalls of conducting use studies. These include poor methodology, imprecise definitions, lack of standardization, and failure to integrate use studies into an on-going process of evaluation.

Perhaps the most glaring shortcoming is poor methodology. Maurice Line complains that data collection techniques and methodology generally are not sound in library use studies.[19] John Budd criticizes what he terms "slipshod research."[20] He particularly warns of trying to quantify the unquantifiable in a search for increasing objectivity. Such attempts lead to confusing results and build more, not less, subjectivity into decision making. Budd's prescription for avoiding this pitfall is simple: "...conduct the most thorough research possible." prior to developing methodology.[21] In addition, the methodology should be adapted to the library and its objectives and should allow for qualitative judgments by librarians instead of trying to quantify all decisions.

Imprecise definition is a problem which leads ultimately to imprecise research. In discussing the problem of use studies as they relate to collection development, Charles Osburn suggests that a critical limitation is that the term "use" is given only vague definition.[22] Robert Broadus agrees and suggests that this failure of definition leads to imprecise

measurement.[23] What is meant by in-library use of materials is a prime example. Is consultation at the shelf a use? Or must the item be removed to a table to be considered used? The question can, of course, be carried much farther. Is the result of the use important? Should use be categorized according to the amount of desired information retrieved? If so, how is this to be measured? These are difficult questions and are probably beyond the ability of present research to resolve. For now, the key is to clearly define what is meant by use so that its meaning is clear to others who will evaluate the results.

Kaske also identifies imprecision as a problem. He suggests that data definitions be standardized. Greater standardization in data collection techniques and analysis is also needed so that the results of studies can be compared.[24]

Finally, use studies should be part of an on-going process of evaluation. Osburn touches on this, suggesting that evaluation of use is easily skewed unless traced over a long period.[25] The continuous nature of evaluation is one of the main principles of Vernon Palmour's work on planning in libraries.[26] It should be remembered also that use represents only one side of the equation. Past use may predict future use with a high degree of validity but it says nothing about nonuse or, to put it another way, potential use.

It is increasingly recognized that libraries need to become more dynamic and to discover needs not being met. Use studies are of limited value here. While trends in use can be gleaned from use studies, the information is pertinent only to a library's present stock of users. Further, use studies measure these user needs indirectly. They merely

discover which parts of the present collection meet certain expressed needs. User studies, on the other hand, measure these needs directly. Clearly, use studies must be augmented with studies of users in order to complete the picture of needs and maximize the information available for decision making.

If the pitfalls are avoided, a use study can greatly increase the objectivity of decisions. Just as important, conducting a use study can educate library and user groups about the library collection within the context of its community of users. This will in turn lead to more thinking about issues and concerns and ultimately about the library's mission and objectives. This sharpening of focus will result in new questions being asked and can only improve the chances that the right question is, after all, the very essence of good research. Use and user studies then will generate, as a by-product, better research studies.

Methodology

The first step in developing the methodology of UC's study was to consult the literature on use studies. While aspects from various studies were employed (such as Trueswell's last date of circulation) the final product represented a mixture of methodologies. These were tailored to gather the information anticipated to be necessary for the decisions at hand and the particular constraints of gathering data at UC. To insure the soundness of the methodology, it was reviewed by several groups within the library. As a final check it was reviewed by the Behavioral Sciences Laboratory at UC. This group assists humanitites and social sciences researchers in developing methodologies and analyzing results.

In retrospect, it can be said that the methodology succeeded in producing valid results but that a slightly different design which broke the larger subclasses into large number groupings would have yielded more useful information. The PRs are the best example. They occupy 8,902 linear feet (13.76%) of the collection. It would have been useful to know the relative usage within so great a portion of the collection. On the other hand, the study generated more than enough information to assist in making the decisions for which it was intended. There was strong feeling among librarians that subclasses should not be split for purposes of storage. They felt that date of publication and type of material would provide fine enough distinctions for both storage and conversion decisions. One reason why finer breakdowns were rejected was the concern among members of the committee about being able to carry out the data gathering as planned. It must be remembered that this was the first large scale study of collection use attempted at UC. Everyone involved wanted to avoid needless complexity to insure that the results would be valid. According to Boomer, one of the problems with operations research today is that researchers have a tendency to develop studies which are too complex to be implemented.[27] This pitfall was to be avoided.

Serials do not circulate at the Central Library. Since many subclasses contain a high percentage of serials, it seemed imperative to try to measure in-house use of materials. Because this involved clearing materials left on tables and carrels, it is called the Clearing Study.

The study did not attempt to consider at-the-shelf consultation, where a book is looked at and immediately reshelved by the patron. Use was defined as material taken away from the shelf for consultation. It

was assumed that patrons using material at tables did not then return them to the shelves, but complied with library policy which asks them not to reshelve material. This definition of use is similar to that used by McGrath. He assumed that if a patron, "... reshelved a book after a moment's examination then he demonstrated neither interest nor use and that no count ... need be taken."[28] Admittedly, the point is arguable. At-the-shelf consultation is a type of use but it is more akin to finding the right material, in a sense fine tuning the selection of possible materials begun at the catalog, than to the kind of use which results in obtaining needed information. Certainly there is more similarity between at-the-table use and out-of-library circulation than at-shelf consultation and circulation. An aim of the study was to compare findings between in-house use and circulation.

The details of the Clearing Study follow:

1. Three times per week on a randomly generated day (Monday-Friday) and time (11am, 3pm and 7pm) all books picked up in the stacks from tables, carrels and return trucks were analyzed.
2. The imprint date and interval of circulation (the last two dates of circulation) were recorded on a chart divided by L.C. subclassifications.
3. For this study only, this information was recorded separately for journals and monographs.

Out-of-library circulation was measured by two studies. First was the Tub Study, which was named for the file of Circulation records known as the "tubs." The details follow:

1. An initial count of the tubs was made.
2. Each day (Tuesday-Saturday) the charges for three randomly generated subclasses were counted. Over an eight-week period the charges for each subclass were counted three times.

The methodology duplicated to some extent the discharge study but provided a much larger sample. It also provided information on extended loans. Books charged to faculty and graduate students on extended loans, a quarter for graduate and a year for faculty, have less chance to circulate repeatedly than books charged to undergraduates where turnover due to loan length is three weeks.

The second study of circulation was taken as books were discharged. The details of the Discharge Study follow:

1. Every other day over a forty-two-day period, the discharge records of circulation transactions for a randomly selected stack area (4 North, 4 East, 5 North, 5 East, 6 North and 6 East) were saved.
2. Usage for each stack area was recorded at three times.
3. The month and year of the previous date due stamp (not the one being discharged) was recorded along with the book's date of imprint.

Validity of Study

The worries expressed about meeting the randomized data collection schedules turned out to be unfounded. Data collection was nearly perfect. A very small percentage of clearing pickups were started somewhat later than their scheduled times. On two occasions, a day scheduled for a

discharge count was missed but made up the next day. Because the sample period was so long, extending almost the entire length of fall quarter, these were minor problems and had no impact on the validity of the results.

There were some problems with missing data in the clearing and discharge studies as Table 1 shows.

Table 1: Missing Data

Study	Total Cases	Cases for Date of Previous Charge	Cases for Date of Imprint	Missing Data % for Previous Charge	Missing Data % for Date of Imprint
Discharge	744	637	738	14.39	0.89
Clearing	4,722	2,447	4,539	48.18	3.87

Missing data in these categories was anticipated. In addition to human error during data collection, missing data can result from the information for some breakdowns simply not being available. Information on date of previous circulation could be unavailable because a book contained a new date due slip or lacked one entirely. Further, since serials do not circulate except for internal charges to graduate carrels and faculty studies, a very small percentage of serials would show a history of previous circulation. The latter assumption is borne out by the fact that the percentage of missing data was so much lower in the discharge study (14%) than in the clearing study (48%) for previous charge. Serials made up only a fraction of items in the discharge study but represented 43% of the items in the clearing study.

The percentage of missing data for the breakdown by imprint is almost certainly due to human error. It is interesting that the percentage is much lower, less than 1%, in the discharge study than in the clearing study

at nearly 4%. This can probably be attributed to the fact that full-time staff recorded data in the discharge study while students were responsible for data collection in the clearing study. The fact that the clearing study dealt with over six times the number of items may also have contributed to the higher error rate.

Certainly missing data problems must have occurred in the studies by Trueswell and Reed. If they did, they were not reported. As was mentioned earlier, Kent has been criticized for not reporting missing data.

Two methodology problems became clear as the results began to be analyzed. The sample size for the discharge study, 744 cases, was not large enough. A number of breakdowns by type of material, year of charge, or imprint had counts of zero when further subdivided by subject discipline. It is unfortunate that the error was not caught when the methodology was tested. The number of sample periods could have been increased. The tub data had a much larger sample population comprising 35,694 cases. It is, therefore, to be preferred as a measure of out-of-library use. The clearing study also used a larger sample population, 4,722 cases, and is to be preferred to the discharge study for information on breakdowns by type of material, etc. It should be pointed out that a small sample is not, in itself, a problem if its results can be extrapolated to the whole collection with reasonable confidence. This does not seem to be the case with the discharge study. The results of the discharge study are reported throughout the paper, but were not used in making the decisions for either storage or retrospective conversion. A second problem in methodology is that materials used on weekends were inadequately measured by the clearing study. Only the Monday morning clearing reflected any weekend use. This short-coming was

realized when the methodology was developed. It was felt that meeting scheduled clearing times would be a problem on weekends due to the fact that fewer full-time staff would be available to supervise. In hindsight, given how well the rest of the data collection went, this may have been needlessly pessimistic.

Due to the differences in methodologies, it had been expected that the three studies would be in considerable disagreement as to the rankings of subclasses by usage. As an examination of Appendix B, "A Comparison of Usage Among Three Studies," will reveal, the opposite was true. The vast majority of subclasses ranked in the first twenty in the tub study also appeared in the first twenty in the other two studies as well. Only four do not appear in the first twenty in the clearing study and six do not appear in the discharge study. Ten are common to all: BF, E, F, HD, [illegible], LB, PN, PQ, PR, PS.

Agreement was even more pronounced among rankings in the lower half of the three studies. Only five items ranked in the lower half of the tub study showed up in the upper half of the clearing study. Similarly, only six items in the lower half of the tub study are in the upper half of the discharge study.

There were some notable areas of disagreement, but these were expected based upon differences in the relative mix of monographs and journals in a subclass. Since journals do not circulate, subclasses with a high proportion of serial titles would show much lower usage in the studies measuring circulation than in the clearing study which measured in-house use. The APs best illustrate this. The subclass is comprised entirely of journals. Consequently, it ranked 98th in the tub study and did not appear at all in the discharge study. It ranked 8th in usage, however, in the clearing study.

Results and Conclusions

The most relevant information to decisions regarding storage and retrospective conversion is the percentage of use by subclass. This data is presented in Appendix B. The study also sought to determine the use characteristics of the collection which might be of value in assisting decision making. The study discovered relationships between use and date of previous charge, date of imprint, and type of material.

A comparison of use with date of previous charge confirmed the findings of Trueswell that material which has seen recent use accounts for a large percentage of total collection use. Figure 1 shows the distribution for both in-house use as measured by the clearing study and out-of-library use as measured by the discharge study. Charges in 1982 (last year) accounted for 56% of all out-of-library use. Material used during the last three years accounted for 83% of all circulation. The percentages for in-house use for last year (1982) and the last three years were somewhat lower: 45% and 76% respectively. This can readily be seen in Figure 1. The curve for the clearing study, though still quite sharp, is flatter than the curve in the discharge study.

It is interesting to compare the percentage of circulation use over time in this study to Trueswell's findings. At one library he found that a cutoff date based on use in the last 18 months would result in a collection which met 90% of user needs.[29] In another he found the time period necessary for that level of user satisfaction to be five years.[30] Reed found that 90% of needs could be satisfied within three years.[31] The study at UC showed that a longer time period was necessary. To satisfy 90% of out-of-library demand, material showing charges back to 1977 (six years) would

have to be kept in the main collection. To satisfy the same level of demand for in-house use the cutoff date would have to be 1975, an eight-year period.

The information on usage compared to date of imprint confirmed research of Fussler and others that more recent materials receive greater use. Reference to Figure 4 shows that the percentage of usage falls sharply after 1970. It should be kept in mind in looking at the curves that the climb in usage from the 1980s to the 1970s results from the face that the most recent decade is comprised of only three years. If the counts for 1980s are adjusted for this fact, the curve would show a downward slope indicating that recency of imprint correlates with percentage of use.

Unlike the data on date of previous charge, decade of imprint shows greater use of recent materials in-house. The 1980s accounted for 22% of use in-house compared to only 9% of out-of-library use. The last thirteen years, from 1970 on, accounted for 61% of use in-house but only 40% of out-of-library use. The reason is that use of serials shows up in the counts of decade of imprint but does not register dates of previous charge in the clearing study.

The information on meeting a given percentage of user needs is quite different if one looks at a breakdown by date of imprint rather than by date of previous charge. Because the study grouped material with imprint dates prior to 1940, it was impossible to determine a cutoff date which would permit UC to meet 90% of user needs. Nevertheless, it is clear that the data gives very different conclusions. By including material from 1940 on, UC could meet only 80% of user needs for out-of-library

circulation. UC could meet but 79% of in-house requirements with a cutoff date for imprints of 1960. The data seems to support Fussler and Simon's assertion that date of publication is less precise in predicting future use than date of previous charge. At the same time, it is clear that recently published material is more likely to be used.

Some of the most interesting data concerns the relative usage of monographs and serials. Since serials do not circulate at UC, the data was gathered for in-house use. Usage for serials published recently was greater than for monographs. Of all usage of serials, material published after 1970 accounted for 55%. Only 12% and 48% of all monographs used were published after 1980 and 1970 respectively. Figure 7 compares the distribution of monographs and serials by decade of imprint.

Overall, the ratio of monographs to serials used was 1.3 to 1. Table 2 shows the change in usage over time between monographs and serials:

Table 2: Ratios of Monographs to Serials

Decade	1980	1970	1960	1950	1940	1930 & back
Ratio	1:2.3	1.1:1	2:1	2.8:1	2.3:1	3.5:1

Clearly, usage of monographs to serials increases sharply over time. The usage of serials is so much greater from 1980 to present, however, that the overall advantage in usage of monographs in-house is slight.

Individual subject disciplines vary widely in terms of usage characteristics. While analysis was not performed at the level of the individual subclasses, some attempt was made to assess these differences by dividing all subclasses into the broad categories of humanitites, social sciences, and sciences.

The categorization is admittedly arbitrary. The placement of many subjects is arguable. Is History a humanity or a social science? What

about Anthropology? It conceivably could be placed in all three categories. Both History and Anthropology were assumed for the purposes of the analysis to be social sciences. Appendix A provides a list of subclasses categorized by discipline and should be consulted before accepting the following analysis.

Figures 1, 2, and 3 show distributions for the humanities, social sciences, and sciences, respectively, compared to the distribution for all disciplines combined. In both the discharge and clearing studies, the category with the highest percentage of previous charges in 1982 was the sciences. The social sciences were next and the humanities third.

The distribution of the three categories, based upon date of imprint, are shown by Figures 4, 5, and 6. A greater percentage of the use in the sciences is accounted for by the more recent imprints than is true in the social sciences or humanities. The percentage of humanities with 1970 or 1980 imprints was the lowest of all disciplines.

Figures 7, 8, and 9 show the distribution for the three disciplines by use of monograph and serial in the clearing study. The greatest percentage of use of recent imprints for serials within a discipline was in the sciences, followed by the social sciences and finally, the humanities. The situation is slightly different for use of monographs. The highest percentage of use of recent imprints for monographs was in the social sciences. Sciences were next. The use of older materials, 1930s and back, was very pronounced for the humanities. Nearly 20% of serial use and 22% of all monograph use in the humanities were for materials published prior to 1940.

A comparison of total use of monographs and serials in these three categories is revealing. For the sciences and social sciences, use of

these two types of materials is nearly equal, monographs accounting for 49% in the sciences and 52% in the social sciences. The situation is far different in the humanities where 83% of all use is accounted for by monographs.

Generalizations about particular subjects divided into the three categories of sciences, social sciences, and humanities must be made with some care. This is especially true when dealing with subclasses categorized as social sciences. History, for example, shows a pattern of use of monographs to serials which very nearly matches use in the humanities. Use of older materials is also much greater in subclasses which comprise History than is true of other social sciences. In fact, if all subclasses related to History are removed from the social sciences, the percentage of use within the social sciences represented by recent materials and serials jumps dramatically.

Using the Study for Decision-making

Six decision rules thought to be pertinent to selecting items for retrospective conversion were developed. These were distributed along with supporting data from the study to decision makers prior to the decision meeting.

The first rule was that candidates would be drawn from subclasses which had shown high usage in either the clearing or tub study. Clearly, the library wanted to convert items which were likely to be used.

The second rule was that subclasses considered must have a high percentage of monographs which had shown use. Monographs were preferred for conversion for the following reasons:

1. Serial titles are more difficult to search for in OCLC.
2. Serials conversion would have necessitated making decisions about entering holdings.
3. Because holding information on serials would have to be added at a later date it would have necessitated using the "save" file in OCLC. This was not possible since the conversion project of Classics material was using this file to capacity.
4. There was a greater probability of finding "hits", that is existing cataloging for particular monograph titles, in the OCLC data base.

The third rule was that subclasses considered have a high percentage of pre-1970 materials which had shown use. Most materials with imprints more recent than 1970 were acquired after UC joined OCLC and were already converted.

Rules four, five and six were merely refinements of the rules mentioned above. Rule four stated that a high concentration within a particular decade prior to 1970 made a subclass a good candidate because it further narrowed the retrospective conversion decision to imprints of a particular decade or decades. Rule five was simply a corollary to this. Pre-1970 concentrations which had a high percentage of monographs were preferred. The sixth rule stated that discriminations among candidates which had emerged from the other rules be judged on the basis of recent intervals of charge. This was an attempt to account for trends in usage by looking at the percentage of use represented by previous charges over the last three years.

Application of the decision rules to the data quickly sifted out many subclasses from consideration. Many of the social sciences for example, were easily eliminated because too great a percentage of materials used were serials. The humanities showed heavy usage of monographs with imprints prior to 1970. For most subclasses showing high overall usage the 1960s represented significant percentages of used materials.

It was interesting that new decision rules emerged during the decision meeting. Concern over cost dictated that conversion be carried out by student assistants. This led to the entire P classification being dropped from consideration. It was felt that converting the Ps would add too many complications to the project due to the amount of duplication in the OCLC database and the likelihood of encountering multiple editions. Some decision rules were changed. It was decided not to convert one or two decades of imprints within a subclass which had shown high use. The Catalog Department felt it was more efficient when working with the

shelflist at the terminal to convert all monographs within a subclass than to find and convert certain imprint dates for many subclasses.

The initial materials selected for conversion were the Bs, the Rs, and four Q subclasses (QA, QD, QL, QP). Interestingly, the decision was modified later due to the decision to weed the Qs and Rs. Since the library wanted to avoid converting material which might be weeded, the PTs and Es were substituted. The conversion of the Qs and Rs will take place next year.

Five decision rules for selecting material for storage were developed. First, selection was to be made from items which had been part of the storage collection prior to the Blegen renovation. Second, both in-library and out-of-library usage was to play a prominent part. Usage information from the clearing and tub studies was made available. This information for items formerly in storage is included in Appendix C. Third, selection was to be made at the class and subclass level. In an important departure from the past, subclasses were not to be broken into large number groups. It was felt that the former practice had led to problems in record keeping and patron education. Fourth, it was decided to select as little material as possible for storage. Analysis of the usage data revealed that much material which had been in storage received significant use when housed with the main collection. Fifth, subjective judgments regarding the importance of keeping some low use materials in the main collection would be sought from librarians. This not only recognized existing expertise but served as a way of accounting for research needs unlikely to be apparent from measures of use.

None of the decision rules were discarded during the decision-making process, although some were modified. Because care had been taken to

develop sound methodology and to consult with librarians and administrators, usage as measured in the study was accepted as a prime selection criterion. There was concern over not breaking subclasses into number groups. This was put to rest by allowing exceptions for some serial titles and a few large monographic series. The Rand Publications are probably the best example.

The most interesting result concerned rule number four, retiring as little as possible to storage. Upon occupying the new library in 1978, it had been decided to keep the stacks at 80% of capacity. Because the study revealed such heavy use of materials formerly in storage, it was decided to increase the quantity of materials housed to 90% of capacity. It is interesting to compare the effect on usage of this decision. To get down to 80% of capacity, 13,000 linear feet representing 10% of total collection use in both the clearing and tub studies would have had to have been retired. By accepting a figure of 90% of capacity, only 6,482 linear feet representing 2% of use in the clearing study and 3.4% of use in the tub study was retired.

Recommendations For Further Research

Use studies can assist in collection development, as long as the precaution concerning the necessity of augmenting use studies with user studies is observed. Demonstrated use of an existing collection provides only a partial conception of user needs.

One method sometimes used is to compare the percent of collection use represented by a subclass to the percent of the collection it comprises to determine its utilization. A subclass is overutilized if its use is

greater than its percentage of the collection. It is underutilized if the reverse is true. Table 3 provides utilization figures for the twenty highest ranked subclasses in the tub and clearing studies. The method tends to penalize subclasses which are both large and are comprised of material primarily of interest to researchers. The PRs, although ranked very high in both studies were very much underutilized. Because the method does identify areas of the collection which are receiving a great deal of use in comparison to their size it can reveal trends in usage and suggest collection strengths which might be built on.

The study would have been more useful for collection development purposes if the subclasses had been broken down into classification number groups. Future studies should be undertaken to assist with collection development and should take this fact into consideration.

One of the most important findings of the Pittsburgh study was the tracking of acquisitions for one year to determine the effects of aging on the probability of circulation. It found that the probability of circulation decreased by approximately 50% per year.[32] This should be studied at UC. If a similar pattern is revealed, it would argue for changing budgeting priorities and allocating more staff to cataloging. The current cataloging backlog of one to two years may have a serious impact on collection use.

A system of on-going evaluation of collection use and user needs should be developed. The former can largely be taken care of by the future automated system. Lancaster warns that the tracking of material for statistical purposes must be carefully planned for during system development.[33] The problem should be studied now.

Because the automated system will permit catalog records to be easily modified, storage selected at the title level is possible and preferable to

Table: 3

COLLECTION UTILIZATION BY SUBCLASS

SUB-CLASS	RANK IN TUB STUDY	RANK IN CLEARING STUDY	% OF COLLEC-TION	% OF USE IN TUB STUDY	% OF USE IN CLEARING STUDY	UTILIZATION OVER (+) UNDER (-) TUB STUDY	CLEARING STUDY
PR	1	5	13.76	8.5	4.61	-5.26	-3.15
PS	2	12	2.72	6.02	2.43	+3.3	-0.29
BF	3	2	1.5	5.03	6.32	+3.53	+4.82
HD	4	7	3.08	4.7	4.02	+1.62	+0.94
E	5	16	2.87	4.49	1.82	+1.62	-1.05
PQ	6	19	5.23	3.98	1.42	-1.25	-3.81
HV	7	11	0.94	3.57	2.96	+2.63	+2.02
HQ	8	6	0.55	3.23	4.42	+2.68	+3.87
HF	9	1	2.58	3.21	6.47	+0.63	+3.89
LB	10	4	1.89	3.05	4.65	+1.16	+2.76
PN	11	13	2.46	2.86	2.37	+0.4	-0.09
PT	12	22	3.66	2.57	1.31	-1.09	-2.35
RC	13	14	0.56	2.51	2.37	+1.95	+1.81
Z	14	24	3.51	2.3	1.14	-1.21	-2.37
F	15	10	2.35	2.12	3.02	-0.23	+0.67
B	16	36	2.35	2.04	0.72	-0.31	-1.63
HM	17	17	0.68	1.95	1.75	+1.27	+1.07
DS	18	21	1.77	1.6	1.33	-0.17	-0.44
HB	19	18	1.06	1.48	1.73	+0.42	+0.67
DA	20	40	2.29	1.32	0.61	-0.97	-1.68
AP	98	8	0.45	0.08	3.99	-0.37	+3.54
L	84	9	1.14	0.13	3.21	-1.01	+2.07
LC	25	15	0.47	1.16	2.01	+0.69	+1.54
PE	36	20	0.44	0.66	1.35	+0.22	+0.91

the present method of selection by subclass. Automation, however, will not eliminate the need for use studies. In-house use must still be determined. Books will still have to be picked up from tables on the basis of a randomized schedule. Bar codes will allow in-house usage information to be gathered for individual titles. Methods based on shorter sample periods should be developed so evaluation can be carried out both more regularly and less expensively.

Evaluation of Study

The study cost $4,811. Computer time accounted for $700. Staff expenses accounted for the rest, $2,642 being spent on student assistants and $1,469 being spent on full-time staff. The most expensive single cost, $2,119, was for development of the methodology and the writing of the programs. Analysis of the results was next at $1,207.

Data collection was not as expensive as anticipated, totaling only $785. The tub study cost $420. The clearing study which was the most labor intensive cost only $351 because it required only student staff. The discharge study cost only $15.

In evaluating the study in terms of cost, it must be remembered that the methodology and the programs for randomization and analysis may be of value to future use studies at UC. If this turns out to be the case, future studies should be less expensive.

Of course, the costs of the study must be weighed against its benefits. It is too early to assess the decisions reached concerning retrospective conversion and storage. For now some apparent successes can be pointed out. The study's methodology produced results which appear to be reliable.

The library was comfortable enough with the results to incorporate them into the decision-making process. The study demonstrated that randomized schedules for data collection could be met and that library staff could carry out the analysis of that data.

Most importantly, the study was a tremendous educational experience for those involved. Not only did the library learn much about conducting a use study but it learned a great deal about the characteristics of collection use.

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Appendix A: Breakdown of LC Subclasses by Discipline

SCIENCE

G	Geography (General)
GA	Cartography
GB	Physical Geography
GC	Oceanography
GF	Human Ecology
Q	Science (General)
QA	Mathematics
QB	Astronomy
QC	Physics
QD	Chemistry
QE	Geology
QH	Natural History (General)
QK	Botany
QL	Zoology
QM	Human Anatomy
QP	Physiology
QR	Microbiology
R	Medicine (General)
RB	Pathology
RC	Internal Medicine
RD	Surgery
RE	Ophthalmology
RF	Otorhinolaryngology
RG	Gynecology & Obstetrics
RJ	Pediatrics
RK	Dentistry
RL	Dermatology
RM	Therapeutics
RS	Pharmacy
RT	Nursing
RV	Botanic, Thomsonian, & Eclectic medicine
RX	Homepathy
RZ	Other systems of medicine
S	Agriculture (General)
SB	Plant Culture
SD	Forestry
SF	Animal Culture
SH	Aquaculture
SK	Hunting
T	Technology (General)
TA	Engineering
TC	Hydraulic Engineering
TD	Environmental Technology
TE	Highway Engineering
TF	Railroad Engineering
TG	Bridge Engineering
TH	Building Construction
TJ	Mechanical Engineering
TK	Electrical Engineering
TL	Motor vehicles, aeromautics astronautics
TN	Mining Engineering
TP	Chemical Technology
TS	Manufactures
UG	Military Engineering
VM	Naval Architecture

SOCIAL SCIENCE

BF	Psychology
C	Auxiliary sciences of history (General)
CB	History of civilization & culture (General)
CC	Archeology (General)
CD	Diplomatics. Archives. Seals.
CE	Technical chrolology. Calendar
CJ	Numismatics
CN	Epigraphy. Inscriptions
CR	Heraldry
CS	Generalogy
CT	Biography
D	History (General)
DA	Great Britain
DB	Austrai
DC	France
DD	Germany
DE	Mediterranean Region
DF	Greece
DG	Italy
DH-DJ	Netherlands. Belgium. Luxemburg
DK	Russia
DL	Northern Europe. Scandinavia
DP	Spain. Portugal
DQ	Switzerland
DR	Eastern Europe
DS	Asia
DT	Africa
DU	Oceania
DX	Gypsies
E	History: America (General)
F	History (1-975-U.S. local history 1001-3799-North & South America [non-U.S.])
GN	Anthropology
GR	Folklore
GT	Manners & Customs (General)
GV	Recreation
H	Social Sciences (General)
HA	Statistics
HB	Economic Theory
HC	Economic History
HD	Land, Argiculture. Industry
HE	Transportation & Communication
HF	Commerce
HG	Finance
HJ	Public Finance
HM	Sociology (General)
HN	Social History
HQ	Social Groups
HS	Societies
HT	Communities
HV	Social Pathology
HX	Socialism. Communism. Anarchism
J	Official Documents
JA	Collections & General works
JC	Political Theory
JF	Constitutional History (General)
JL	Constitutional History - British America & Latin America
JN	Constitutional History - Europe
JQ	Constitutional History - Asia, Africa, Australia, Oceania
JS	Local Government
JV	Colonies & Colonization
JX	International Law
KD	Law of England & Wales
KDC	Law of Scotland
KDE	Law of Northern Ireland
KDG	Law of Isle of Man & The Channel Islands
KDK	Law of Ireland
KF	Law of the U.S.
KFA-KFW	Law of Individual States
KFX	Law of Individual Cities
KFZ	Law of Individual Territories
L	Education (General)
LA	History of Education
LB	Theory & Practice of Education
LC	Special Aspects of Education
LD	Individual Institutions - U.S.
LE	Individual Institutions - America except U.S.
LF	Individual Institutions - Europe
LG	Individual Institutions - Asia, Africa, Oceania
LH	College & School Magazines
LJ	Student Fraternities & Societies, U.S.
LT	Textbooks
RA	Public Aspects of Medicine
TX	Home Economics
U	Military Science (General)
UA	Armies
UB	Military Administration
UC	Maintenance & Transportation
UD	Infantry
UE	Cavalry
UF	Artillery
UH	Other Services
V	Naval Science (General)
VA	Navies - Organization
VB	Naval Administration
VC	Naval Maintenance
VD	Naval Seamen
VE	Marines
VF	Naval Ordnance
VG	Minor Services of Navies
VK	Navigation

HUMANITIES

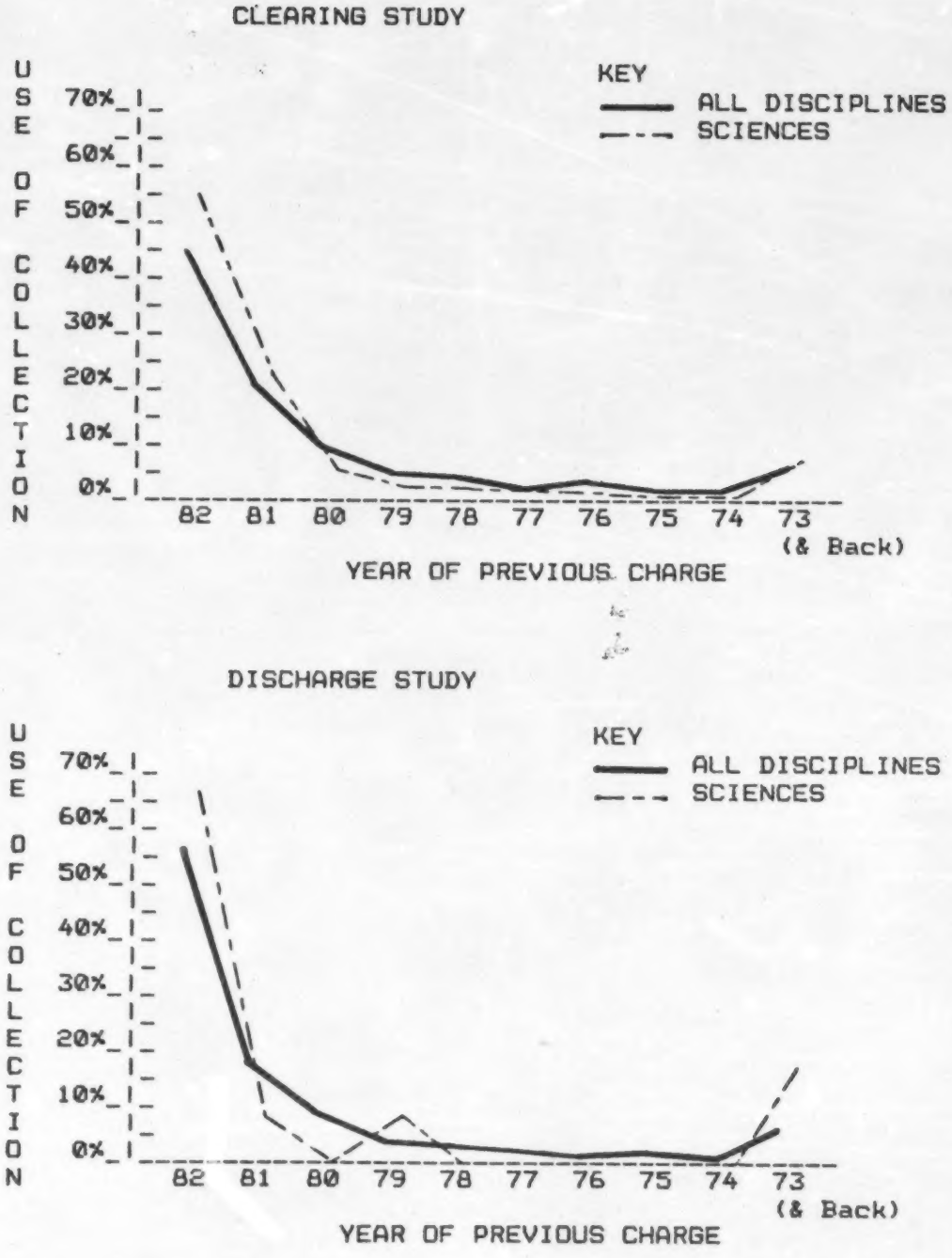
B	Philosophy
BC	Logic
BD	Speculative Philosophy
BH	Aesthetics
BJ	Ethics
BL	Religion
BM	Judaism
BP	Islam
BQ	Buddhism
BR	Christianity
BS	Bible
BT	Doctrinal Theology
BV	Practical Theology
BX	Denominations & Sects
M	Music
ML	Literature of Music
MT	Music Instruction & Study
N	Visual Arts (General)
NA	Architecture
NB	Sculpture
NC	Drawing
ND	Painting
NE	Print Media
NK	Decorative Arts
NX	Arts in General
P	Philology & Linguistics (General)
PA	Classical Languages & Literature
PB	Modern European Languages - General works
PC	Romance Languages
PD	Germanic Languages
PE	English
PF	West Germanic
PG	Slavic Languages & Literature
PH	Finno-Ugrian & Basque Languages & Literature
PJ	Oriental Languages & Literature
PK	Indo-Iranian
PL	Languages & Literature of East Asia, Africa, Oceania
PM	American Indian Languages
PN	Literary History & Collections General
PQ	Romance Literature
PR	English Literature
PS	American Literature
PT	Germanic Literature
PZ	Mysteries, Science Fiction, Juvenile Literature
TR	Photography
TT	Handicrafts

ALL

AC	General Works: collections & series
AE	Encyclopedias
AG	Dictionaries & general reference works
AI	Indexes
AM	Museums
AN	Newspapers
AP	Periodicals
AS	Academies & learned societies
AY	Yearbooks
AZ	History of scholarship & learning
C.U.	Theses & Dissertations
Z	Bibliography, Library Science

APPENDIX B

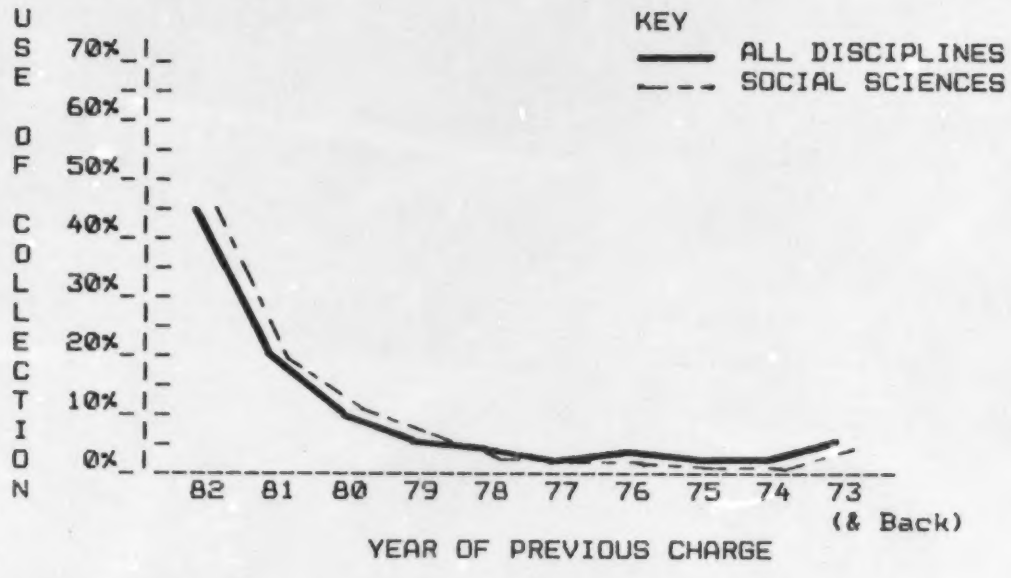
FIGURE 1
DISTRIBUTION OF USE
BASED ON YEAR OF PREVIOUS CHARGE



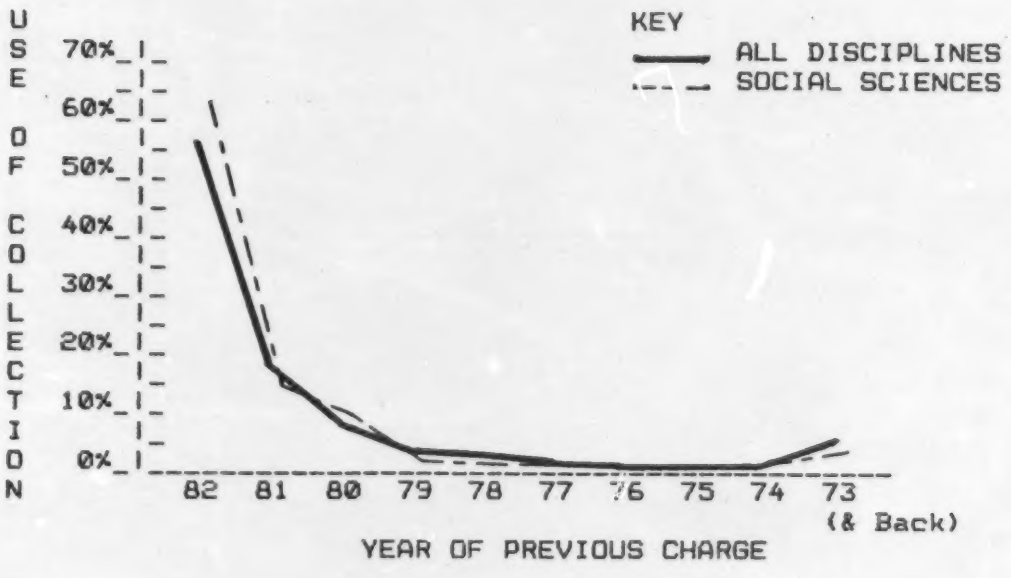
APPENDIX B

FIGURE 2
DISTRIBUTION OF USE
BASED ON YEAR OF PREVIOUS CHARGE

CLEARING STUDY



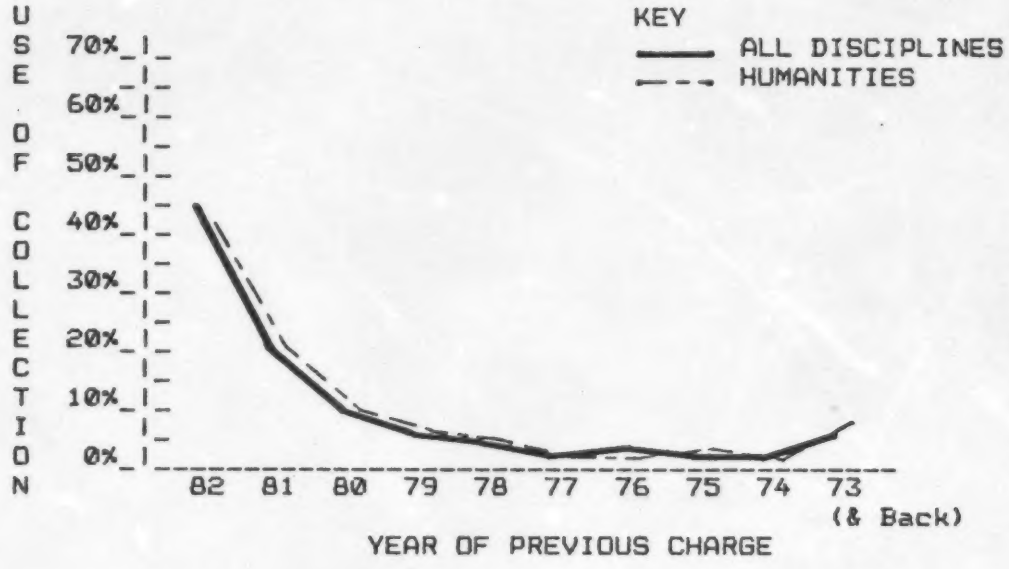
DISCHARGE STUDY



APPENDIX B

FIGURE 3
DISTRIBUTION OF USE
BASED ON YEAR OF PREVIOUS CHARGE

CLEARING STUDY



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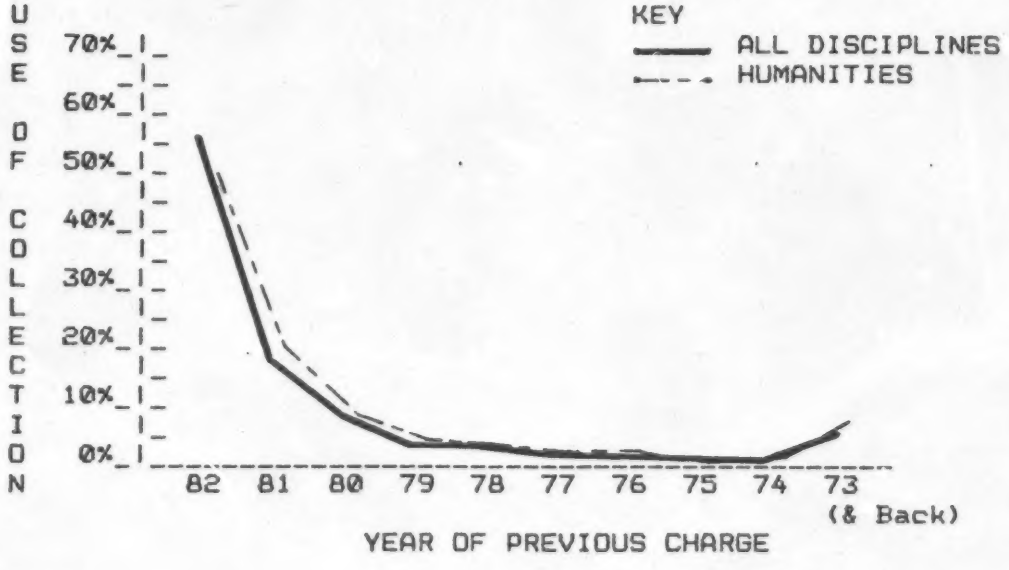
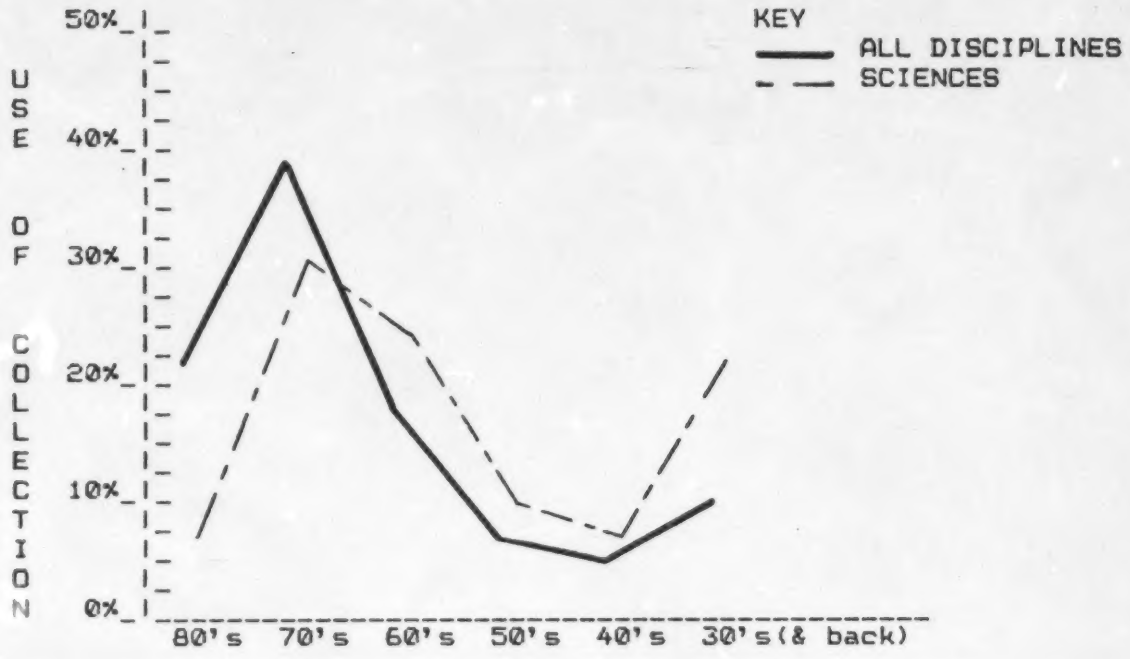


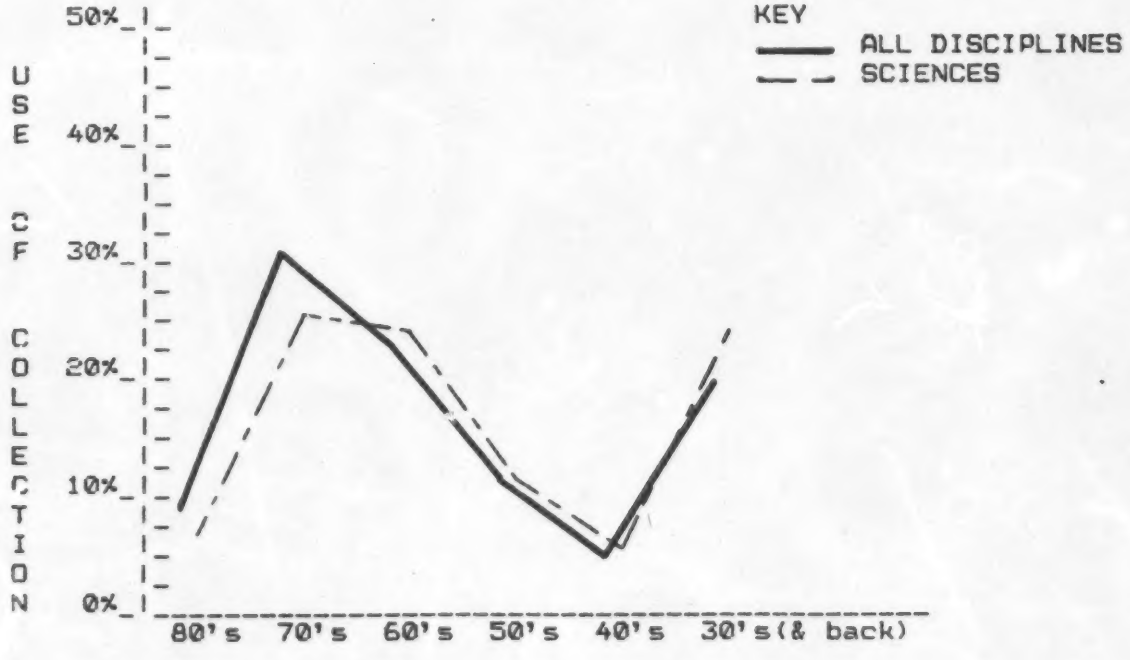
APPENDIX B

FIGURE 4
DISTRIBUTION OF USE
COMPARISON OF STUDIES
BASED ON DECADE OF IMPRINT

CLEARING STUDY



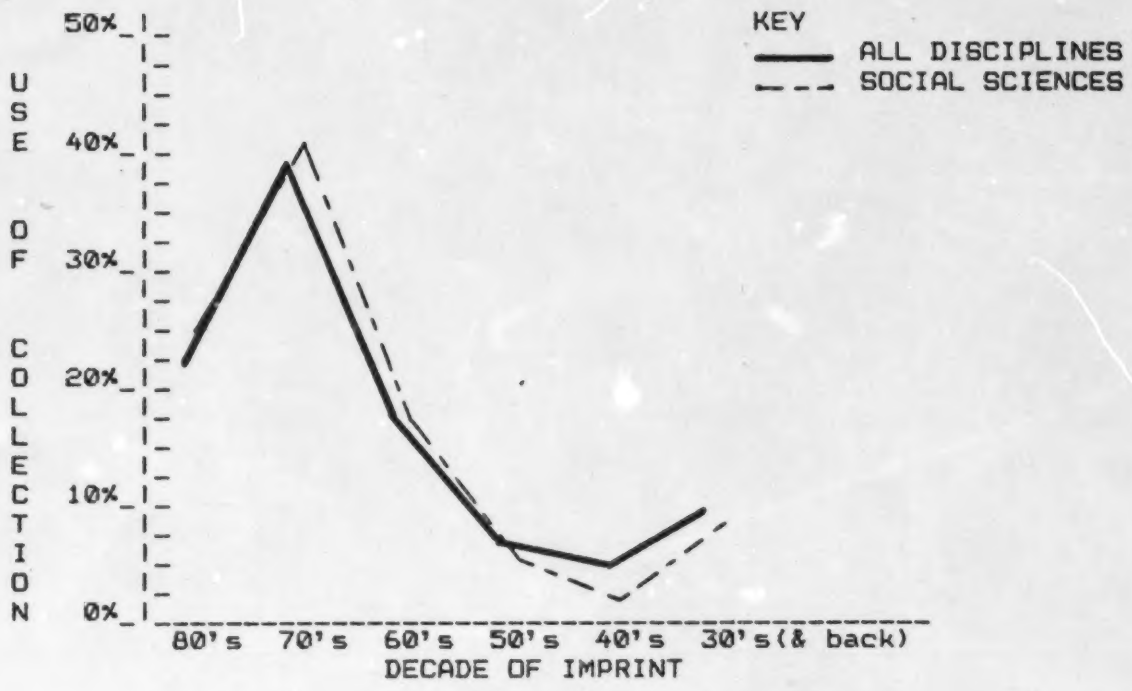
DISCHARGE STUDY



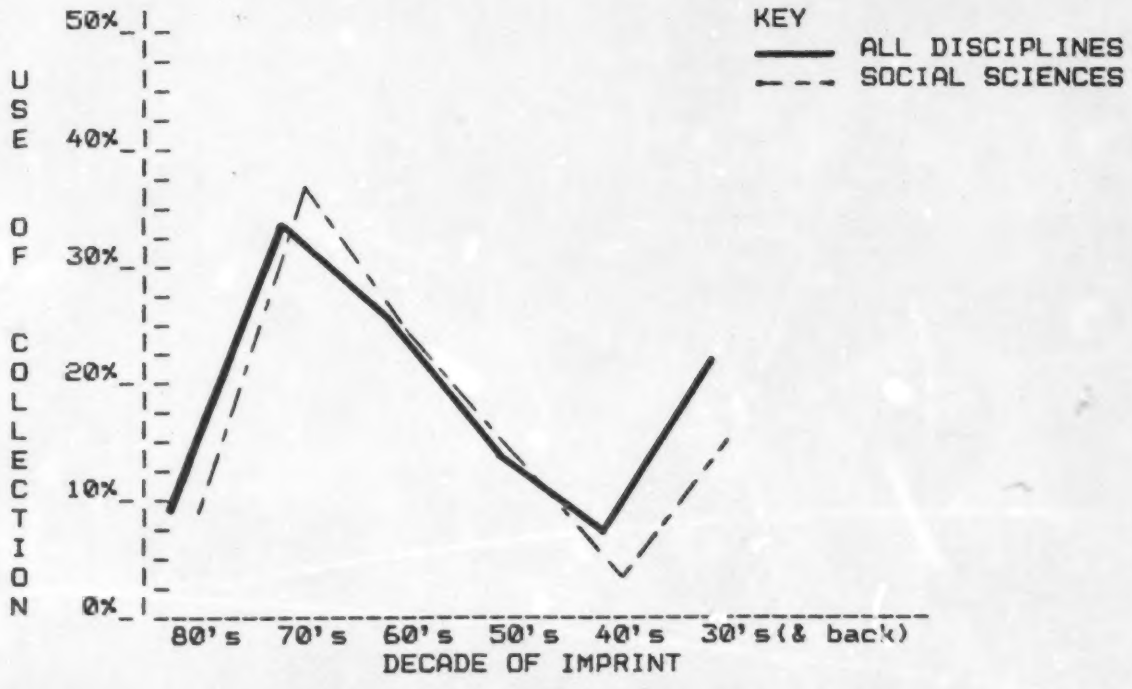
APPENDIX F

FIGURE 5
DISTRIBUTION OF USE
COMPARISON OF STUDIES
BASED ON DECADE OF IMPRINT

CLEARING STUDY



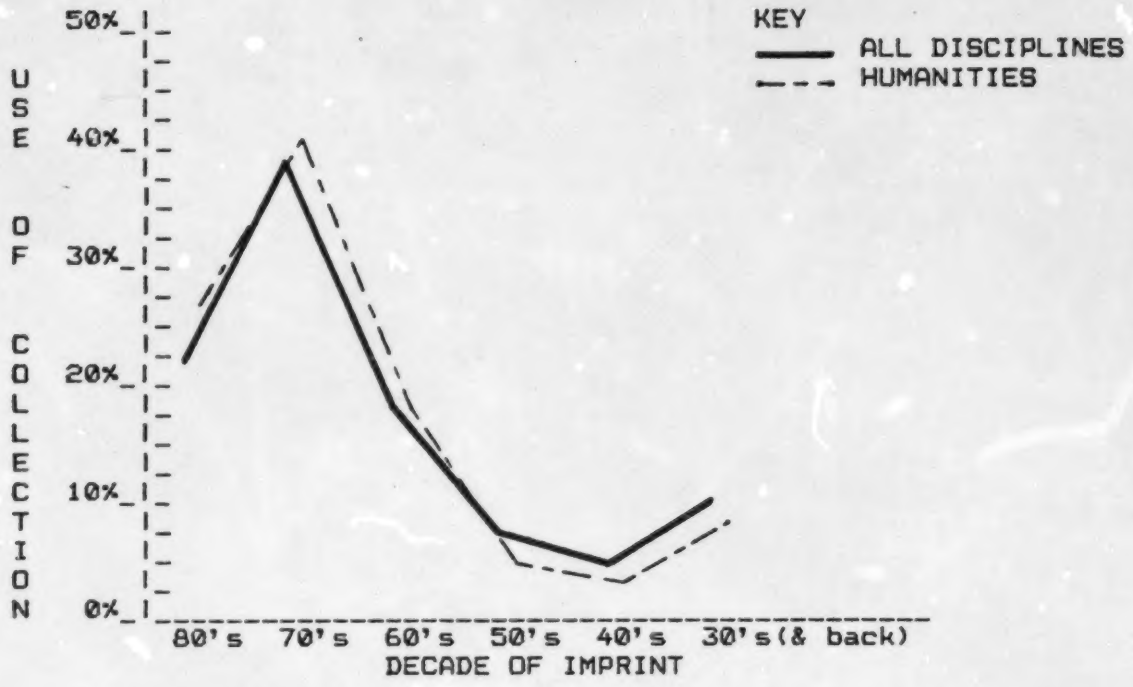
DISCHARGE STUDY



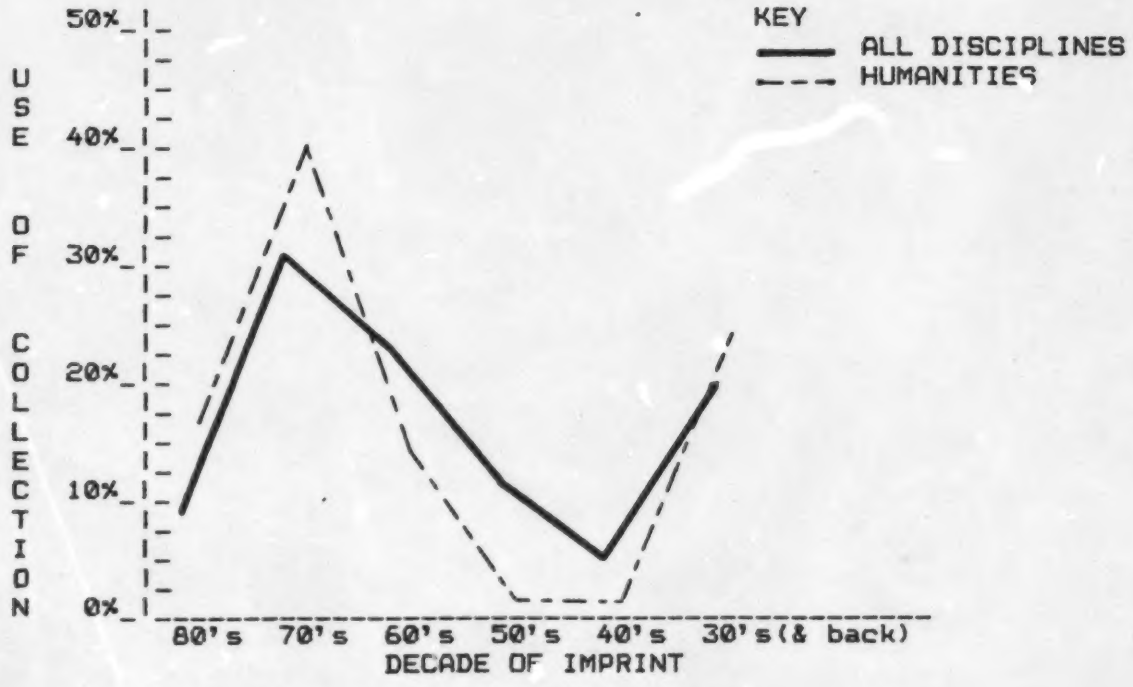
APPENDIX B

FIGURE 6
DISTRIBUTION OF USE
COMPARISON OF STUDIES
BASED ON DECADE OF IMPRINT

CLEARING STUDY



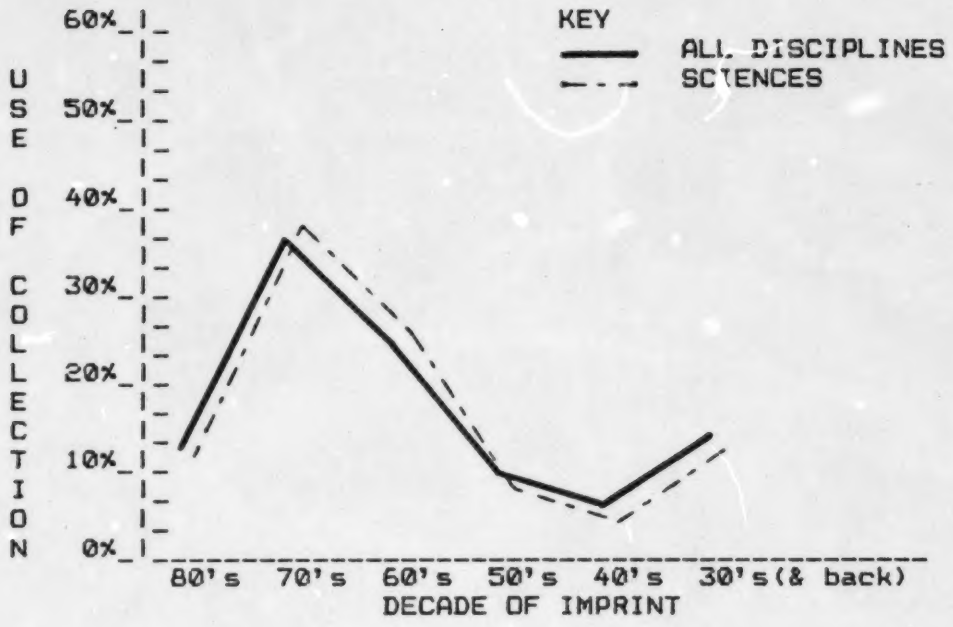
DISCHARGE STUDY



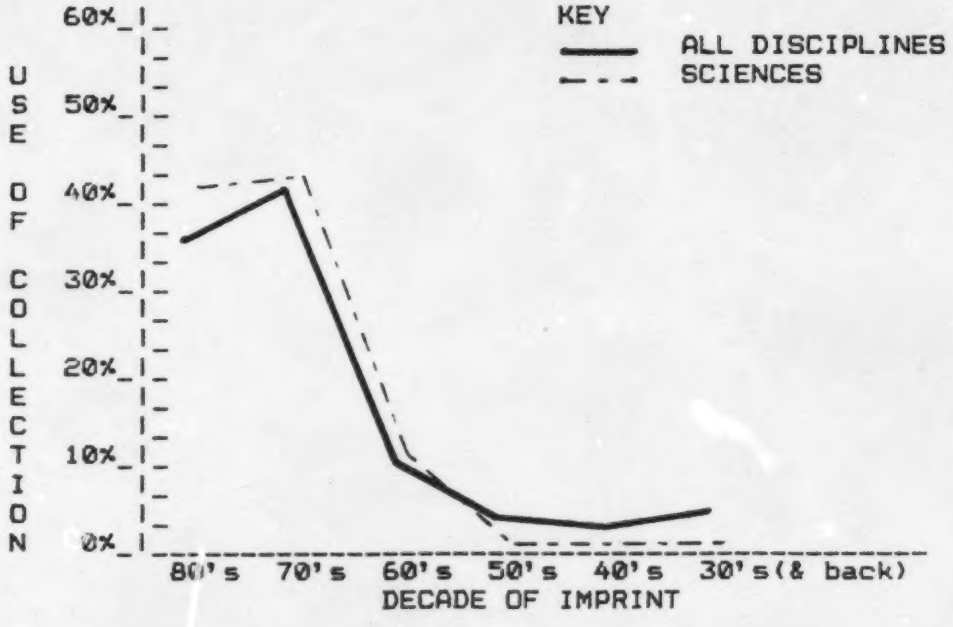
APPENDIX B

FIGURE 7
DISTRIBUTION OF USE
COMPARISON OF STUDIES
BASED ON DECADE OF IMPRINT

MONOGRAPHS



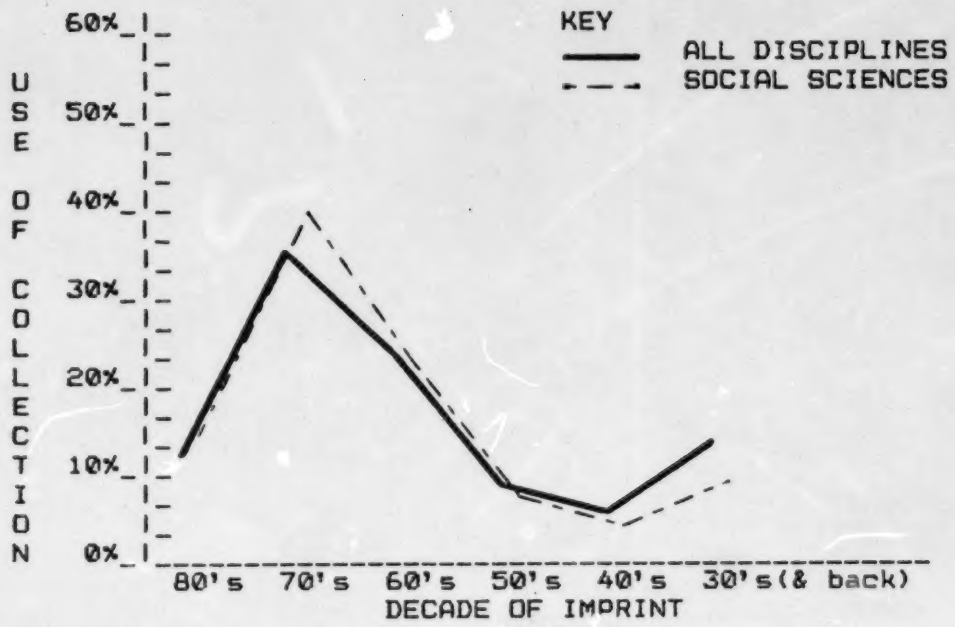
SERIALS



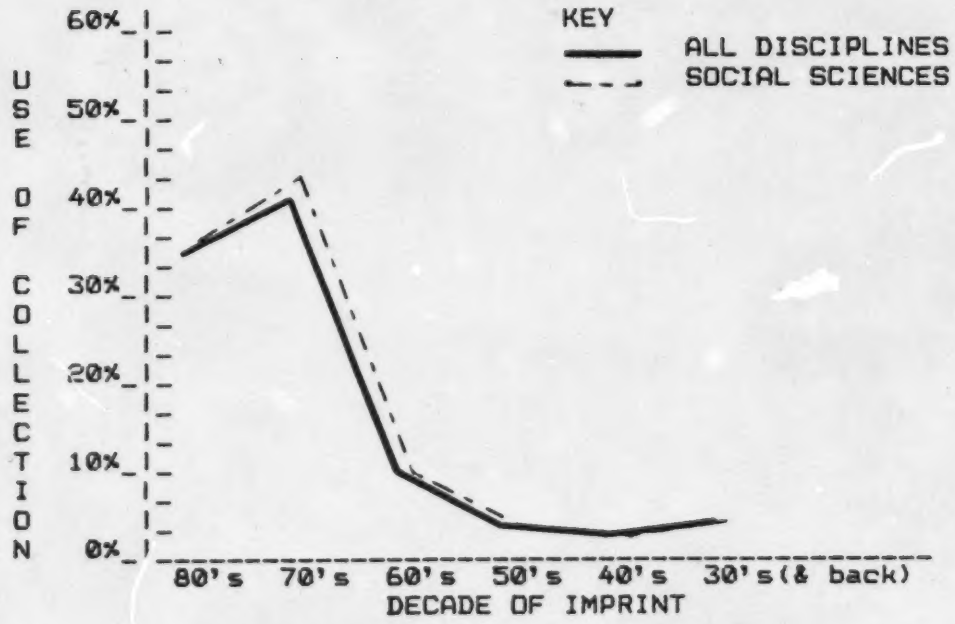
APPENDIX B

FIGURE 8
DISTRIBUTION OF USE
COMPARISON OF STUDIES
BASED ON DECADE OF IMPRINT

MONOGRAPHS



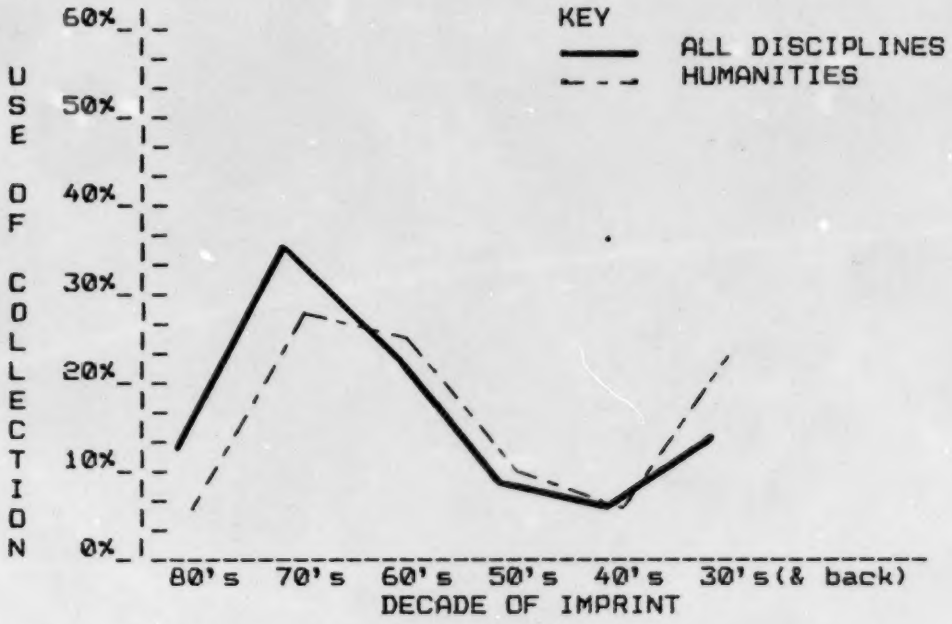
SERIALS



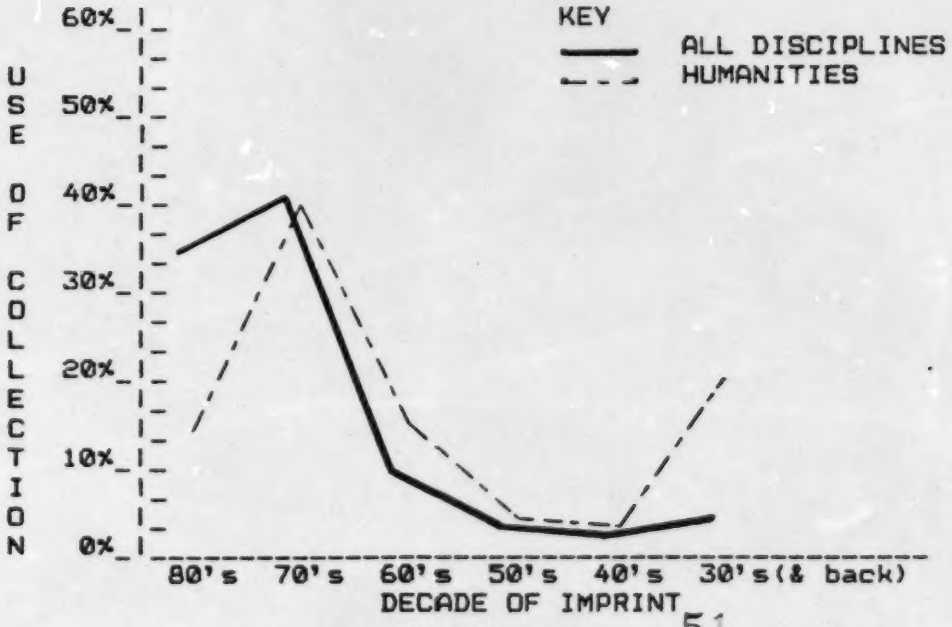
APPENDIX B

FIGURE 9
DISTRIBUTION OF USE
COMPARISON OF STUDIES
BASED ON DECADE OF IMPRINT

MONOGRAPHS



SERIALS



APPENDIX C

COMPARISON OF USAGE AMONG THREE STUDIES

DEFINITION: USAGE = THE % OF THE TOTAL COLLECTION REPRESENTED BY SUBCLASS

TOTAL CASES STUDIED:

1) TUB STUDY -- 35694
2) CLEARING STUDY -- 4722
3) DISCHARGE STUDY -- 744

	TUB STUDY			CLEARING STUDY			DISCHARGE STUDY		
RANK	LC.SUB. LFT.	COUNT	USAGE(%)	LC.SUB. LFT.	COUNT	USAGE(%)	LC.SUB. LFT.	COUNT	USAGE(%
1	PR.....8902	2999	8.5037	HF.....1667	386	6.4666	PR.....8902	104	13.9785
2	PS.....1760	2123	6.0198	BF..... 971	299	6.3187	BF..... 971	89	11.9624
3	BF..... 971	1773	5.0274	HG.....1085	266	5.6213	PS.....1760	75	10.0806
4	HD.....1989	1658	4.7013	LB.....1221	220	4.6492	PQ.....3381	62	8.3333
5	E.....1855	1585	4.4943	PR.....8902	218	4.6069	B.....1522	40	5.3763
6	PQ.....3381	1404	3.9811	HQ..... 359	209	4.4167	LB.....1221	38	5.1075
7	HV..... 610	1260	3.5727	HD.....1989	190	4.0152	E.....1855	28	3.7634
8	HQ..... 359	1139	3.2296	AP..... 289	189	3.9941	PT.....2369	28	3.7634
9	HF.....1667	1133	3.2126	L..... 734	152	3.2122	F.....1520	19	2.5538
10	LB.....1221	1075	3.0482	F.....1520	143	3.0220	PN.....1590	14	1.8817
11	PN.....1590	1008	2.8582	HV..... 610	140	2.9586	DS.....1145	10	1.3441
12	PT.....2369	906	2.5690	PS.....1760	115	214303	LC..... 301	9	1.2097
13	RC..... 360	887	2.5151	PN.....1590	112	2.3669	HD.....1989	9	1.2097
14	Z.....2267	810	2.2968	RC..... 360	112	2.3669	RA..... 203	9	1.2097
15	F.....1520	748	2.1210	LC..... 301	95	2.0076	BD..... 109	9	1.2097
16	B.....1522	721	2.0444	E.....1855	86	1.8174	JC..... 180	8	1.0753
17	HM..... 442	687	1.9480	HM..... 442	83	1.7540	DC..... 926	8	1.0753
18	DS.....1145	564	1.5992	HB..... 684	82	1.7329	HF.....1667	7	0.9409
19	HB..... 684	521	1.4773	PQ.....3381	67	1.4159	QA..... 287	7	0.9409
20	DA.....1478	467	1.3242	PE..... 287	64	1.3525	HG.....1085	7	0.9409
21	HG.....1085	459	1.3015	DS.....1145	63	1.3314	PJ..... 82	6	0.8065
22	HC.....1172	451	1.2788	PT.....2369	62	1.3102	BS..... 189	6	0.8065
23	JK..... 475	444	1.2590	JK..... 475	60	1.2680	HV..... 610	5	0.6720
24	D.....1725	414	1.1739	Z.....2267	54	1.1412	P..... 367	5	0.6720
25	LC..... 301	410	1.1626	HJ..... 533	53	1.1200	PE..... 287	5	0.6720
26	QA..... 287	358	1.0151	HC.....1172	53	1.1200	BV..... 133	5	0.6720
27	P..... 367	351	0.9953	Q..... 817	51	1.0778	BR..... 443	5	0.6720
28	KF..... 244	307	0.8705	HT..... 185	50	1.0566	D.....1725	5	0.6720
29	CU..... 460	300	0.8507	P..... 367	49	1.0355	DA.....1478	5	0.6720
30	HT..... 185	277	0.7854	BV..... 158	45	0.9510	BT..... 91	4	0.5376

	TUB STUDY				CLEARING STUDY				DISCHARGE STUDY			
RANK	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%
31	GV.....	158	269	0.7628	H.....	651	44	0.9298	BJ.....	123	4	0.5376
32	Q.....	817	249	0.7060	RA.....	203	43	0.9087	R.....	102	4	0.5376
33	JC.....	180	243	0.6890	TL.....	108	39	0.8242	BL.....	246	4	0.5376
34	RJ.....	66	236	0.6692	QA.....	287	36	0.7608	T.....	196	4	0.5376
35	GN.....	432	234	0.6635	HN.....	265	34	0.7185	L.....	734	4	0.5376
36	PE.....	287	231	0.6550	B.....1522		34	0.7185	BX.....	646	4	0.5376
37	DC.....	926	224	0.6352	G.....	686	32	0.6762	ML.....	1	3	0.4032
38	HN.....	265	219	0.6210	HE.....	339	32	0.6762	JK.....	475	3	0.4032
39	RA.....	203	219	0.6210	JX.....	869	31	0.6551	NX.....	27	3	0.4032
40	H.....	651	216	0.6125	DA.....1478		29	0.6128	KF.....	244	3	0.4032
41	BL.....	246	176	0.4991	D.....1725		27	0.5706	PB.....	216	3	0.4032
42	HX.....	224	172	0.4877	U.....	56	25	0.5283	LA.....	240	3	0.4032
43	LA.....	240	164	0.4650	HA.....	274	24	0.5072	HM.....	442	3	0.4032
44	DK.....	373	156	0.4423	T.....	196	20	0.4227	DT.....	353	3	0.4032
45	TX.....	160	150	0.4253	KF.....	244	20	0.4227	BP.....	31	3	0.4032
46	QP.....	187	138	0.3913	LD.....	101	19	0.4015	UH.....	6	3	0.4032
47	HJ.....	533	137	0.3885	BL.....	246	19	0.4015	RS.....	3	3	0.4032
48	BX.....	646	137	0.3885	CU.....	460	17	0.3593	RC.....	360	3	0.4032
49	JA.....	268	134	0.3800	GN.....	432	17	0.3593	GV.....	158	3	0.4032
50	JS.....	187	134	0.3800	PC.....	492	17	0.3593	HC.....1172		3	0.4032
51	JX.....	869	134	0.3800	NA.....	81	17	0.3593	DD.....	490	2	0.2688
52	PC.....	492	132	0.3743	PZ.....	51	16	0.3381	NA.....	81	2	0.2688
53	DT.....	353	129	0.3658	HX.....	224	16	0.3381	Z.....2267		2	0.2688
54	BR.....	443	128	0.3629	QP.....	187	15	0.3170	BH.....	50	2	0.2688
55	HA.....	274	127	0.3601	LE.....	3	14	0.2959	PC.....	492	2	0.2688
56	DD.....	490	126	0.3573	RF.....	6	14	0.2959	AC.....	99	2	0.2688
57	BS.....	189	123	0.3488	BX.....	646	14	0.2959	QL.....	186	2	0.2688
58	PF.....	295	115	0.3261	RJ.....	66	13	0.2747	GR.....	133	2	0.2688
59	PG.....	345	113	0.3204	AN.....	12	12	0.2536	QC.....	177	1	0.1344
60	HE.....	339	100	0.2836	JA.....	268	11	0.2325	U.....	56	1	0.1344
61	G.....	686	97	0.2750	DT.....	353	11	0.2325	VM.....	8	1	0.1344
62	R.....	102	94	0.2665	TS.....	113	11	0.2325	VK.....	20	1	0.1344
63	BJ.....	123	93	0.2637	GR.....	133	11	0.2325	TL.....	108	1	0.1344
64	BM.....	73	92	0.2609	UA.....	60	11	0.2325	UB.....	22	1	0.1344
65	BD.....	109	92	0.2609	DP.....	225	10	0.2113	TC.....	16	1	0.1344
66	JF.....	69	90	0.2552	BQ.....	8	10	0.2113	TH.....	16	1	0.1344
67	DG.....	460	82	0.2325	BR.....	443	9	0.1902	RJ.....	66	1	0.1344
68	N.....	301	80	0.2268	LA.....	240	9	0.1902	AS.....	116	1	0.1344
69	CB.....	195	79	0.2240	LJ.....	12	9	0.1902	DF.....	13	1	0.1344
70	BV.....	133	66	0.1871	JF.....	69	9	0.1902	CU.....	460	1	0.1344
71	BC.....	63	62	0.1758	PL.....	113	8	0.1691	DL.....	44	1	0.1344
72	PL.....	113	62	0.1758	DU.....	122	8	0.1691	DG.....	460	1	0.1344
73	JN.....	175	59	0.1673	AG.....	5	8	0.1691	DP.....	225	1	0.1344
74	BT.....	91	58	0.1645	N.....	301	7	0.1479	AN.....	12	1	0.1344
75	RF.....	6	58	0.1645	UG.....	28	7	0.1479	AV.....	6	1	0.1344

	TUB STUDY				CLEARING STUDY				DISCHARGE STUDY			
RANK	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%
76	NA.....	81	57	0.1616	RM.....	38	7	0.1479	CB.....	195	1	0.1344
77	CT.....	120	56	0.1588	PB.....	216	7	0.1479	BQ.....	8	1	0.1344
78	UA.....	60	56	0.1588	PD.....	123	7	0.1479	CT.....	120	1	0.1344
79	T.....	196	52	0.1474	QL.....	186	7	0.1479	LD.....	101	1	0.1344
80	TS.....	113	52	0.1474	K.....	210	7	0.1479	KT.....	1	1	0.1344
81	QH.....	280	50	0.1418	JN.....	175	7	0.1479	LT.....	1	1	0.1344
82	QB.....	99	47	0.1333	GT.....	25	6	0.1268	PH.....	20	1	0.1344
83	GR.....	133	47	0.1333	DX.....	5	6	0.1268	PG.....	345	1	0.1344
84	L.....	734	46	0.1304	LF.....	41	6	0.1268	GF.....	24	1	0.1344
85	PZ.....	51	45	0.1276	TX.....	160	6	0.1268	DU.....	122	1	0.1344
86	PB.....	216	42	0.1191	SF.....	18	5	0.1057	GN.....	432	1	0.1344
87	JV.....	72	41	0.1163	SK.....	17	5	0.1057	HX.....	224	1	0.1344
88	AS.....	116	38	0.1077	DC.....	926	5	0.1057	HA.....	274	1	0.1344
89	QC.....	177	35	0.0992	S.....	105	5	0.1057	PL.....	113	1	0.1344
90	NK.....	31	32	0.0907	TF.....	8	4	0.0845	------			
91	QL.....	186	32	0.0907	TP.....	62	4	0.0845	------			
92	GT.....	25	31	0.0879	GF.....	24	4	0.0845	------			
93	U.....	56	31	0.0879	ND.....	93	4	0.0845	------			
94	TK.....	51	31	0.0879	CT.....	120	4	0.0845	------			
95	ND.....	93	29	0.0822	BJ.....	123	4	0.0845	------			
96	RM.....	38	28	0.0794	JC.....	180	4	0.0845	------			
97	PK.....	53	28	0.0794	PF.....	295	4	0.0845	------			
98	AP.....	289	28	0.0794	NK.....	31	4	0.0845	------			
99	DP.....	225	26	0.0737	QH.....	280	4	0.0845	------			
100	PJ.....	82	26	0.0737	CS.....	65	3	0.0634	------			
101	RG.....	5	25	0.0709	NX.....	27	3	0.0634	------			
102	DU.....	122	24	0.0681	TR.....	42	3	0.0634	------			
103	NX.....	27	23	0.0652	BS.....	189	3	0.0634	------			
104	J.....	1092	23	0.0652	CJ.....	10	3	0.0634	------			
105	DF.....	13	22	0.0624	TA.....	40	3	0.0634	------			
106	RT.....	11	22	0.0624	RG.....	5	3	0.0634	------			
107	GF.....	24	22	0.0624	PJ.....	82	3	0.0634	------			
108	PM.....	27	22	0.0624	PG.....	345	3	0.0634	------			
109	TL.....	108	21	0.0595	PK.....	53	3	0.0634	------			
110	JQ.....	82	21	0.0595	DF.....	13	3	0.0634	------			
111	DB.....	46	21	0.0595	JS.....	187	2	0.0423	------			
112	LD.....	101	21	0.0595	TK.....	51	2	0.0423	------			
113	AC.....	99	20	0.0567	CB.....	195	2	0.0423	------			
114	BP.....	31	19	0.0539	TD.....	19	2	0.0423	------			
115	DR.....	86	18	0.0510	NC.....	30	2	0.0423	------			
116	BH.....	50	17	0.0482	UB.....	22	2	0.0423	------			
117	CS.....	65	16	0.0454	BP.....	31	2	0.0423	------			
118	PD.....	123	15	0.0425	AS.....	116	2	0.0423	------			
119	UF.....	6	15	0.0425	UF.....	6	2	0.0423	------			
120	NC.....	30	15	0.0425	DB.....	46	2	0.0423	------			

	TUB STUDY				CLEARING STUDY				DISCHARGE STUDY			
RANK	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%
121	ML.....	1	14	0.0397	CD.....	84	2	0.0423		------		
122	TJ.....	30	14	0.0397	QC.....	177	2	0.0423		------		
123	TD.....	19	13	0.0369	DH.....	27	2	0.0423		------		
124	QK.....	36	13	0.0369	AC.....	99	2	0.0423		------		
125	GA.....	23	13	0.0369	GA.....	23	2	0.0423		------		
126	HS.....	20	12	0.0340	JV.....	72	2	0.0423		------		
127	K.....	210	12	0.0340	DD.....	490	2	0.0423		------		
128	TR.....	42	12	0.0340	J.....	1092	1	0.0211		------		
129	CR.....	15	12	0.0340	R.....	102	1	0.0211		------		
130	TA.....	40	11	0.0312	V.....	48	1	0.0211		------		
131	S.....	105	11	0.0312	QM.....	7	1	0.0211		------		
132	TP.....	62	10	0.0284	VA.....	17	1	0.0211		------		
133	QE.....	101	10	0.0284	DK.....	373	1	0.0211		------		
134	SB.....	45	10	0.0284	DE.....	4	1	0.0211		------		
135	DH.....	27	9	0.0255	GB.....	33	1	0.0211		------		
136	PH.....	20	9	0.0255	TH.....	16	1	0.0211		------		
137	TT.....	14	9	0.0255	LH.....	23	1	0.0211		------		
138	RD.....	11	9	0.0255	BV.....	133	1	0.0211		------		
139	RS.....	3	8	0.0227	RD.....	11	1	0.0211		------		
140	AG.....	5	8	0.0227		------				------		
141	UB.....	22	8	0.0227		------				------		
142	AE.....	141	8	0.0227		------				------		
143	AV.....	6	7	0.0198		------				------		
144	DJ.....	15	7	0.0198		------				------		
145	CD.....	84	7	0.0198		------				------		
146	NE.....	18	7	0.0198		------				------		
147	CC.....	15	7	0.0198		------				------		
148	DL.....	44	7	0.0198		------				------		
149	GB.....	33	6	0.0170		------				------		
150	AZ.....	15	6	0.0170		------				------		
151	BQ.....	8	6	0.0170		------				------		
152	SF.....	18	6	0.0170		------				------		
153	TE.....	10	5	0.0142		------				------		
154	KD.....	12	5	0.0142		------				------		
155	VK.....	20	5	0.0142		------				------		
156	LF.....	41	5	0.0142		------				------		
157	UG.....	20	5	0.0142		------				------		
158	VA.....	17	5	0.0142		------				------		
159	QM.....	7	5	0.0142		------				------		
160	QD.....	3	5	0.0142		------				------		
161	AM.....	1	4	0.0113		------				------		
162	NB.....	21	4	0.0113		------				------		
163	JL.....	24	4	0.0113		------				------		
164	TN.....	32	4	0.0113		------				------		
165	DQ.....	31	4	0.0113		------				------		

	TUB STUDY				CLEARING STUDY				DISCHARGE STUDY			
RANK	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(%)	LC.SUB.	LFT.	COUNT	USAGE(
166	DX.....	5	4	0.0113	------				------			
167	MT.....	1	3	0.0085	------				------			
168	DE.....	4	3	0.0085	------				------			
169	SH.....	22	3	0.0085	------				------			
170	RE.....	5	3	0.0085	------				------			
171	VE.....	19	2	0.0057	------				------			
172	TH.....	16	2	0.0057	------				------			
173	AN.....	12	2	0.0057	------				------			
174	AI.....	10	2	0.0057	------				------			
175	UH.....	6	2	0.0057	------				------			
176	VM.....	8	2	0.0057	------				------			
177	C.....	1	2	0.0057	------				------			
178	LJ.....	12	2	0.0057	------				------			
179	GC.....	7	2	0.0057	------				------			
180	M.....	9	2	0.0057	------				------			
181	V.....	48	1	0.0028	------				------			
182	KB.....	2	2	0.0028	------				------			
183	CJ.....	10	1	0.0028	------				------			
184	LH.....	23	1	0.0028	------				------			
185	UD.....	5	1	0.0028	------				------			
186	KT.....	1	1	0.0028	------				------			
187	UC.....	2	1	0.0028	------				------			
188	RL.....	1	1	0.0028	------				------			
189	RK.....	1	1	0.0028	------				------			
190	TF.....	8	1	0.0028	------				------			
191	RZ.....	2	1	0.0028	------				------			
192	CE.....	6	1	0.0028	------				------			
193	TC.....	16	1	0.0028	------				------			
194	RB.....	5	1	0.0028	------				------			
195	TG.....	2	0	0.0000	------				------			
196	VC.....	1	0	0.0000	------				------			
197	VB.....	1	0	0.0000	------				------			
198	VG.....	1	0	0.0000	------				------			
199	VF.....	1	0	0.0000	------				------			
200	LT.....	1	0	0.0000	------				------			
201	UE.....	1	0	0.0000	------				------			
202	KE.....	2	0	0.0000	------				------			
203	QV.....	1	0	0.0000	------				------			
204	CN.....	3	0	0.0000	------				------			
205	SK.....	17	0	0.0000	------				------			
206	LG.....	3	0	0.0000	------				------			
207	SD.....	15	0	0.0000	------				------			
208	LE.....	3	0	0.0000	------				------			

APPENDIX D

COMPARISON OF USAGE BETWEEN TWO STUDIES
FOR SUBCLASSES FORMERLY IN STORAGE

DEFINITION: USAGE = THE % OF THE TOTAL COLLECTION
REPRESENTED BY SUBCLASS

TOTAL CASES STUDIED:
1) TUB STUDY -- 35694
2) CLEARING STUDY -- 4722

	TUB STUDY				CLEARING STUDY			
NO.	RANK	LC.SUB. LFT.	COUNT	USAGE(%)	RANK	LC.SUB. LFT.	COUNT	USAGE(%)
1	14	Z.....2267	810	2.2968	24	Z.....2267	54	1.1412
2	26	QA..... 287	358	1.0151	27	Q..... 817	51	1.0778
3	32	Q..... 817	249	0.7060	33	TL..... 108	39	0.8242
4	45	TX..... 160	150	0.4253	34	QA..... 287	36	0.7608
5	46	QP..... 187	138	0.3913	42	U..... 56	25	0.5283
6	68	N..... 301	80	0.2268	44	T..... 196	20	0.4227
7	76	NA..... 81	57	0.1616	51	NA..... 81	17	0.3593
8	78	UA..... 60	56	0.1588	54	QP..... 187	15	0.3170
9	79	T..... 196	52	0.1474	59	AN..... 12	12	0.2536
10	80	TS..... 113	52	0.1474	62	TS..... 113	11	0.2325
11	81	QH..... 280	50	0.1418	64	UA..... 60	11	0.2325
12	82	QB..... 99	47	0.1333	73	AG..... 5	8	0.1691
13	88	AS..... 116	38	0.1077	74	N..... 301	7	0.1479
14	89	QC..... 177	35	0.0992	75	UG..... 20	7	0.1479
15	90	NK..... 31	32	0.0907	79	QL..... 186	7	0.1479
16	91	QL..... 186	32	0.0907	80	K..... 210	7	0.1479
17	93	U..... 56	31	0.0879	85	TX..... 160	6	0.1268
18	94	TK..... 51	31	0.0879	86	SF..... 18	5	0.1057
19	95	ND..... 93	29	0.0822	87	SK..... 17	5	0.1057
20	103	NX..... 27	23	0.0652	89	S..... 105	5	0.1057
21	104	J.....1092	23	0.0652	90	TF..... 8	4	0.0845
22	109	TL..... 108	21	0.0595	91	TP..... 62	4	0.0845
23	113	AC..... 99	20	0.0567	93	ND..... 93	4	0.0845
24	119	UF..... 6	15	0.0425	98	NK..... 31	4	0.0845
25	120	NC..... 30	15	0.0425	99	QH..... 280	4	0.0845
26	122	TJ..... 30	14	0.0397	101	NX..... 27	3	0.0634
27	123	TD..... 19	13	0.0369	102	TR..... 42	3	0.0634
28	124	QK..... 36	13	0.0369	105	TA..... 40	3	0.0634
29	127	K..... 210	12	0.0340	112	TK..... 51	2	0.0423
30	128	TR..... 42	12	0.0340	114	TD..... 19	2	0.0423

TUB STUDY

NO.	RANK	LC.SUB.	LFT.	COUNT	USAGE(%)
31	130	TA.....	40	11	0.0312
32	131	S.....	105	11	0.0312
33	132	TP.....	62	10	0.0284
34	133	QE.....	101	10	0.0284
35	134	SB.....	45	10	0.0284
36	137	TT.....	14	9	0.0255
37	140	AG.....	5	8	0.0227
38	141	JB.....	22	8	0.0227
39	142	AE.....	141	8	0.0227
40	143	AY.....	6	7	0.0198
41	146	NE.....	18	7	0.0198
42	150	AZ.....	15	6	0.0170
43	152	SF.....	18	6	0.0170
44	153	TE.....	10	5	0.0142
45	155	VK.....	20	5	0.0142
46	157	UG.....	20	5	0.0142
47	158	VA.....	17	5	0.0142
48	159	QM.....	7	5	0.0142
49	160	QD.....	3	5	0.0142
50	161	AM.....	1	4	0.0113
51	162	NB.....	21	4	0.0113
52	164	TN.....	32	4	0.0113
53	169	SH.....	22	3	0.0085
54	171	VE.....	19	2	0.0057
55	172	TH.....	16	2	0.0057
56	173	AN.....	12	2	0.0057
57	174	AI.....	10	2	0.0057
58	175	UH.....	6	2	0.0057
59	176	VM.....	8	2	0.0057
60	181	V.....	48	1	0.0028
61	185	UD.....	5	1	0.0028
62	187	UC.....	2	1	0.0028
63	190	TF.....	8	1	0.0028
64	193	TC.....	16	1	0.0028
65	195	TG.....	2	0	0.0000
66	196	VC.....	1	0	0.0000
67	197	VB.....	1	0	0.0000
68	198	VG.....	1	0	0.0000
69	199	VF.....	1	0	0.0000
70	201	UE.....	1	0	0.0000
71	203	QV.....	1	0	0.0000
72	205	SK.....	17	0	0.0000
73	207	SD.....	15	0	0.0000

CLEARING STUDY

RANK	LC.SUB.	LFT.	COUNT	USAGE(%)
115	NC.....	30	2	0.0423
116	UB.....	22	2	0.0423
118	AS.....	116	2	0.0423
119	UF.....	6	2	0.0423
122	QC.....	177	2	0.0423
124	AC.....	99	2	0.0423
128	J.....	1092	1	0.0211
130	V.....	48	1	0.0211
131	QM.....	7	1	0.0211
132	VA.....	17	1	0.0211
136	TH.....	16	1	0.0211